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ORIGINAL ARTICLES

FACIAL GROWTH AND MANDIBULAR ADJUSTMENT*†

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INTRODUCTION

IN MY last communication I discussed the phenomena of activity in bone. A telltale vascularization indicates areas of growth or modification of form. This vascularity is present equally in areas where additional bone is being laid down in the course of normal growth,[7] where bone is being repaired after fracture[8] and where bone healing is going on in an amputation stump.[1, 2] When, as in fractures and amputations, the vascularity has been stimulated by a definite cause it is established with remarkable speed. Absorption of existing bone tissue along the damaged line of fracture or operation accompanies this vascularity and is followed by callus formation in more or less exuberant amount. Five days after the incident which stimulates the repair process the bone is distinctly rarefied in the immediate zone,[8] and within eleven days rarefaction has spread in a very extensive manner far from the site of damage.[1, 2]

In the much more orderly progress of regular bone growth the actual phenomena involved are the same, but there is no exuberance in their expression.

Applying this criterion of vascularity to the hard palate, we have seen that the areas where increase in dimensions takes place are clearly delimited. In transverse growth there is, as one would expect, increase on each side of the median intermaxillary suture. It seems curious that this growth is rather sharply limited to the intermaxillary suture and does not spread to the interpremaxillary or interpalatal sutures. One must remember, however, that so-called transverse sutures of the palate, the premaxillary-maxillary and the

*Read at the Twenty-ninth Annual Meeting of the American Society of Orthodontists, Nashville, Tenn., April 8 to 11, 1930.

†From the Hamann Museum, Anatomical Laboratory, Western Reserve University, Cleveland, Ohio.

maxillopalatine, are not really transverse but curved with the convex side of the curves turned toward each other. Consequently, as the palatal processes of the maxillae add to their length in front and behind, they envelop the palatal parts of the other bones. In Fig. 1, which shows the hard palate of the young chimpanzee while the deciduous dentition is still complete, vascularity similar to that in the hard palate is apparent in the alveolar processes. This plainly accompanies the remodelling called forth by the change in dentition and, while obtrusive in appearance, is irrelevant for our present purpose. In the adult (Fig. 2) even before eruption of the third molar, all signs

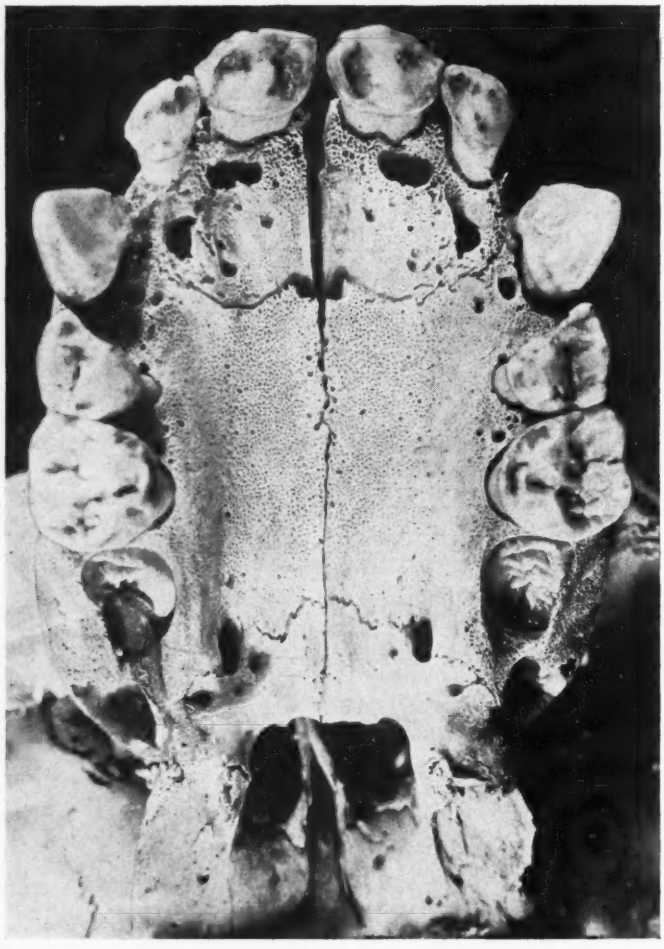


Fig. 1.—Occlusal view of palate and upper dental arch with deciduous dentition complete. Chimpanzee, W.R.U. B410. Note the perforations leading to the crypts for the permanent teeth. Note also the vascularity of alveolar processes and palatal processes of growing maxillae.

of bone growth and activity have disappeared except around the incisors and the third molar, the former because they are significantly loosely set in the jaw, the latter because it is not yet in place.

In the examination of series of skulls of different ages whether of Man or of Apes the anteroposterior growth is not continuous but, after development of the deciduous dentition, is roughly related to the development of the three successive permanent molars. Even though in Apes there is a large canine,

this has little or no relation to the anteroposterior growth, since space for it is attained by growth of the anterior "horns" of the maxillae around the premaxillae.

In both Man and Apes the maxillopalatine suture is present, at least until the attainment of adult life. The premaxillo-maxillary suture, however, disappears very early in human childhood; it remains in the Ape until the attainment of skeletal maturity. This distinction between Apes and Man in palatal, and hence in dental arch growth, is not easy to understand. It can-

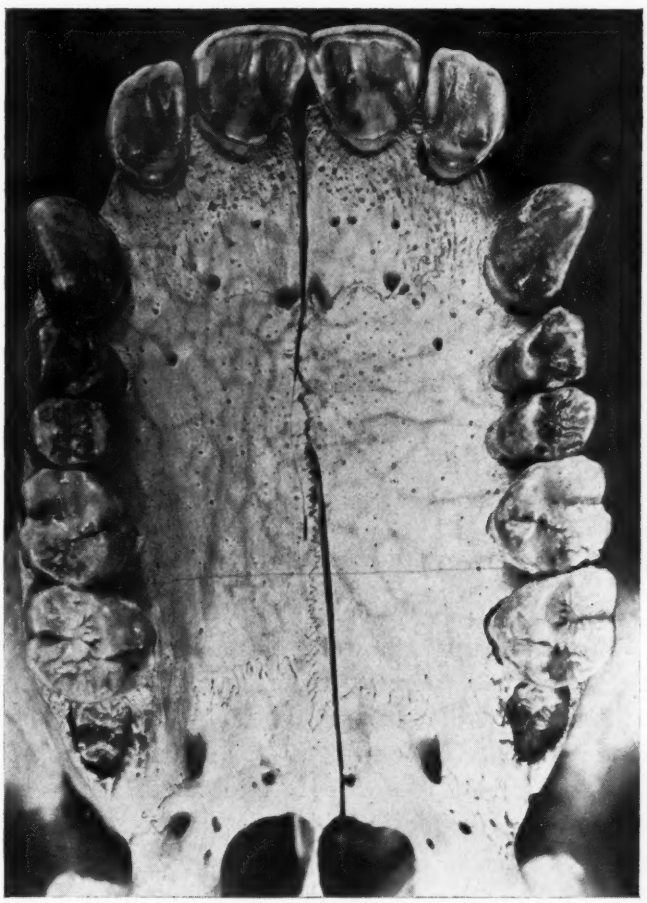


Fig. 2.—Occlusal view of palate and upper dental arch with permanent teeth in place except third molar which is in crypt. Note that vascularity has disappeared from every area save those about incisors and third molar.

not be related to size of canines because the canine space for even the largest tooth is attained by an indirect method already described. In the course of this communication we shall find that the typically enormous brain growth in Man is primarily responsible for the early closure of his premaxillary-maxillary suture. This seems an extraordinarily far-fetched explanation yet, so complex and involved is the pattern of general skull growth, when the evidence is before us, I think we shall have to admit its validity.

Having rehearsed these preliminary though essential observations, the way is clear for a more complete study of palatal growth. We have noted

that increase in breadth between stages of Figs. 1 and 2 is so small as to be dismissed from further consideration. Our immediate problem is vertical facial growth.

I. GROWTH CHANGES OF THE FACIAL MASK

In a hitherto unpublished work Bowman, in this laboratory,* has shown that five-sixths of maximum palatal breadth is already attained at four years and that actual maximum breadth is reached by ten years. Since bizygomatic breadth increases, especially in the male, up to about seventeen years there can be no close growth-relationship between palatal and bizygomatic breadths.[3]

The problem of palatal breadth is a rather vexed one, and a sentence or two are needed to explain the statement of time-relationship. The largest tooth in Man is the first molar. This is a peculiarity belonging to Man alone among higher Primates for in the Anthropoids the second molar is the largest tooth, and indeed, sometimes the third molar, especially in Gorillas, runs it very close. When the first molar is fully developed and erupting, the palate has already reached its approximate maximum breadth. This is not later than the fifth year for, although the tooth may yet be in its crypt, the space needed for its complete development is already provided. Very frequently the term palate breadth refers to some other transverse diameter as, for instance, that between the canines. The permanent canines require much more space than the corresponding milk teeth, and this is more gradually attained than the first-molar palatal breadth. So when we speak of the maximum or full adult palatal diameter we must be careful to define exactly what is meant.

THE CRANIOSTAT

Even when we have simplified our problem by eliminating breadth, we have still many difficulties to encounter. Having designed and manufactured an instrument by which it is possible to make exact orthodiagraphic records of any skull, we discovered that the precise method of hafting facial mask to cranium is quite variable in White skulls. Our American Negro skulls showed much greater uniformity, and it is therefore an American Negro series set up by Miss Tracy in this laboratory[13] which I shall use to demonstrate facial growth.

The method of orientation of the skull, to which we have become accustomed through its almost universal acceptance, calls for the setting up of the skull in such a manner that the lower border of the orbit and the upper border of the external auditory meatus are in the same horizontal plane. This orientation, known as the Frankfort plane, is quite unsatisfactory for our purpose because it ignores the fact that during childhood the human orbit grows in vertical height. This growth is not upward from the Frankfort plane but downward from the craniofacial diaphragm, the orbital roofs. The lower orbital margin is therefore unstable, and its use must result in the upward tilting of the face in progressively older skulls. Krogman has modified this orientation and excluded the unsatisfactory features by the use of what he calls the nasion parallel plane.[6] In actual practice we used

*Anatomical Laboratory, Western Reserve University, Cleveland, Ohio.

Krogman's plane for the series of drawings here put forward, in the following manner: We took the twenty-three-month-old skull, set it up in the Frankfort plane and, after the orthodiagraphic tracing was made, we inscribed on the latter a line parallel with the Frankfort plane but passing through the nasion. Each succeeding skull traced was so oriented that its external auditory meatus (more precisely the porion) was superposed on that of its predecessor and its nasion adjusted to that particular line drawn through the nasion of the twenty-three-month-old skull. By this means we obtain an orientation which enables us to compare with ease the facial growth at different ages.

COORDINATED FACIAL GROWTH

It is not difficult to note that between birth and seven months there is some vertical but far more horizontal growth in the face. The dental arch is growing to accommodate the deciduous teeth. From about seven months to the end of the second year there is a little vertical facial growth but none anteroposteriorly. During third and fourth years facial growth occurs in both directions but is mainly vertical. Between four and seven years, on the contrary, growth is entirely horizontal. This accompanies the later stages of development and eruption of the first permanent molar. The downward and forward growth of the face is continued to the end of the eleventh year, and thus the developing second permanent molar is accommodated. Thereafter until sixteen years there is but little change. Between sixteen and nineteen years there is again forward and downward growth, and space is prepared for the third molar.

There is no slavishly pursued sequence in development of the face. Roughly speaking, anteroposterior growth of the palate follows and is conditioned by the development of the deciduous dental arch and later by the development of the permanent molars. The growth is discontinuous and its maxima occur during the six months succeeding birth for the deciduous dentition, between four and seven years to accommodate first and second permanent molars, and between sixteen and nineteen years to accommodate the third molar.

In a similar manner the discontinuous growth in vertical direction largely conditioned by the increasing respiratory needs of the growing body, has maxima falling respectively into the first six months after birth, during the third and fourth years, from seven to eleven years and again between sixteen and nineteen years. The last of these is partly sexual, and it must not be assumed that the spurts in vertical growth as shown in this statement give a complete picture of respiratory adjustment. One must always remember the increase in lower nasal width.

THE INFLUENCE OF THE EXPANDING BRAIN CASE

Fig. 3 does not fully extract all the information on facial growth, however clearly it may show the characteristic downward and forward direction and its discontinuous character. A very simple procedure enables us to gather

further data from this same series. We therefore readjust the tracings so that the roots of the noses (nasia) are superimposed instead of the ear holes (poria).

The result is apparent in Fig. 4 in which the nasion parallel plane is depicted with the Frankfort plane at a lower level. At intervals along the latter are marked the sites of the ear hole (porion) in succeeding stages of development. The maxima of horizontal growth forward of the face are now seen as the greater intervals along the Frankfort plane. Superposition of

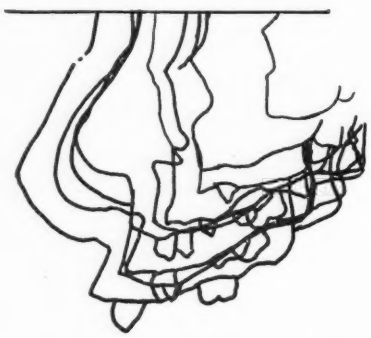


Fig. 3.—Composite drawing of facial growth. Negroes twenty-one days to nineteen years old. Skulls oriented in Krogman's nasion-parallel plane with external auditory meatus (poria) superposed. The general downward and forward facial growth is apparent The vertical component is respiratory and the horizontal is dental.

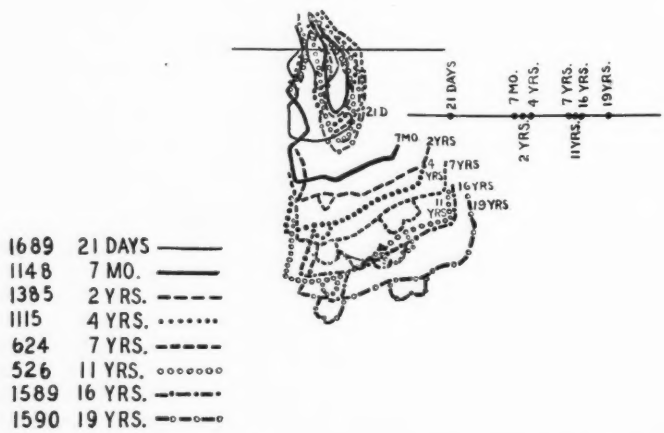


Fig. 4.—Composite drawing of facial growth. Man. Same skulls as in Fig. 3 but all are now superposed on nasion. Note that the mask progresses forward as a unit and the alignment of facial contour, canine and first molar never changes. The orbit is tilted backward as it grows downward. The time-growth relationship, expressed by porion picked out on horizontal line, shows three spurts.

nasia, by a kind of fiction, results in a vertical alignment of the mask. This does not mean that the facial contour never changes its degree of projection; it does mean that with the head so oriented that nasion and porion are maintained a constant vertical distance from each other, the facial contour is also maintained stable. The philosophic fiction of facial contour is of little moment for our purpose; the illustration holds far more significant points. The facial contour being maintained stable in vertical alignment, the canine tooth, whether milk or permanent, is also constant in vertical alignment; so

is the first permanent molar. That whole area of the face including frontal contour, canine and first molar, representing the dentition, grows forward as a unit.

There is another feature in this illustration, important but unobtrusive, namely, the changing slope of the orbit. At first vertical, the orbital point (the lowest point on the inferior orbital border) appears to recede as it grows downward. Now the upper orbital margin is the floor of the brain case and as the latter expands forward during childhood the face, hafted on to its under surface, is carried forward with it. Since, however, the tilt of the orbital outline increases as the child grows, it follows that in its progress forward the brain case outstrips the face. The extra space needed for backward extension of the dental arches to accommodate the full permanent dentition is easily obtained as a result of the carrying forward of facial mask by growing brain case.

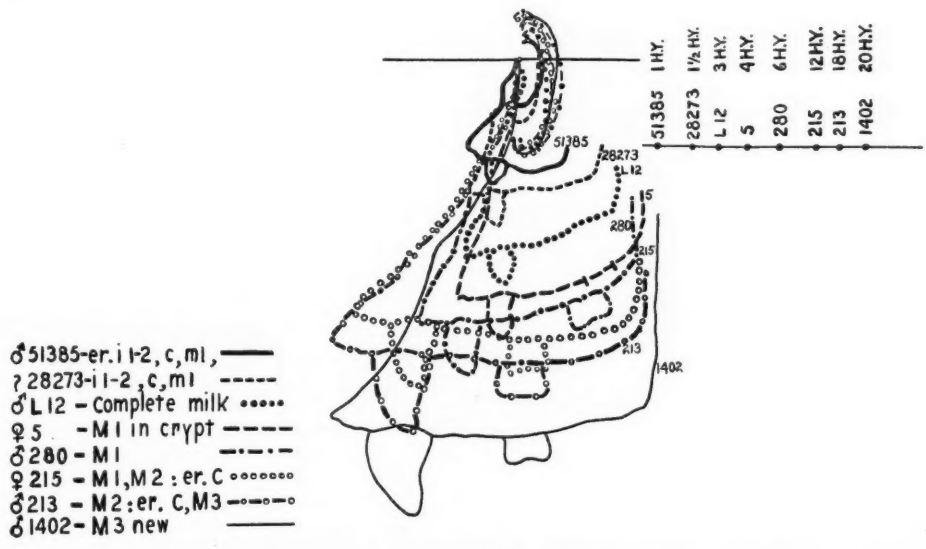


Fig. 5.—Composite drawing of facial growth. Gorilla. The skeletal development is recorded in human years on the line on which the poria are marked. Note that vertical plane of orbit is never tilted as in Man. The alignment of mask and canine is unchanged until four human years. Then forward growth of jaws continues until eighteen human years. Hence non-closure of premaxillary-maxillary suture.

CONTRASTING GROWTH IN THE GORILLA

Oftentimes a truth is rendered more convincing by a contrasting fact. We have spoken of the expanding brain case carrying forward the face, providing facility for backward extension of dental arches and, through a lagging in facial migration, a tilting of the orbit. If this be a correct interpretation, then a similar series of tracings, from skulls of a species of animal which has not so marked a brain expansion as Man, should show a contrasting growth picture. Such a series is at hand in our Gorilla tracings for which I am indebted to Dr. W. M. Krogman. This series has been reproduced as Fig. 5. Brain case and face having kept pace in forward growth, the orbit never tilts; it remains vertical. Forward growth, which is really forward growth of brain case, does not exhibit the discontinuous character so distinctive in human development. The site of the porion recedes in the figure

with ever decreasing speed until adult life. In vertical facial growth there are spurts as in Man, though the first, occurring in the early months of life, cannot be shown here. That occurring during the third and fourth years of Man and the last occurring just before twenty years, are clearly depicted in Gorilla. The spurt between seven and eleven years is not apparent because, at this time in Gorilla, another important change is taking place. Brain case has ceased to grow forward, and no further posterior extension of the dental arches is possible. The increased dental arch space must then be attained some other way. In those specimens of this series which represent the human time interval between four and twelve years the facial mask is growing forward, but this affects only the suborbital area; the orbit itself remains unchanged. With the new method of expansion of dental arch the extension backward ceases; there is practically no further backward growth after four human years (Gorilla No. 5). The swing forward of mask, canine and first molar together is very clearly seen and continues until the age of twelve human years when it ceases and all three features become stabilized once more in vertical alignment.

COMPARATIVE YOUTH

I have used the term "human years" in the preceding paragraphs, and this term merits explanation. It is a device for comparing growth stages in different animals. When we study the development of the human skeleton in postnatal life, we find that it presents a quite definite time-relationship.[9, 10, 11] If this is not attained, or if, as occasionally happens, it is exceeded, some determining factor should be sought. Corresponding stages of skeletal development of the Gorilla are easily recognized if they are defined by their approximate age relationship in Man. The actual chronologic age of the Gorilla, at a similar developmental stage, is, however, very different, at least in later childhood. It is at present felt that a human being of two years corresponds in skeletal development to a Gorilla of about eighteen months. If this be true, a child of five years corresponds to a Gorilla of four, at which stage the marked discrepancy begins for a Gorilla of six years has already reached the developmental phase seen in a human being of twelve years while a Gorilla of seven years is at the twenty-year human stage. If the initial comparison should be equivalence between a Gorilla of one year and a human child of two years, then a Gorilla of three years corresponds to a child of six, a Gorilla of four to a child of twelve, a Gorilla of five to a youth of eighteen years.

A full discussion of this very important phenomenon of human growth, the adolescent lag, appears elsewhere,[12] and we need not delay longer upon the subject. It is obvious though that, if Man takes nine years to do what the Gorilla accomplishes in as many months, ample opportunity is provided in human growth for delay or even inversion of successive engagements. It is this characteristic human delay which provides most of the problems, dental and other, of children in the second decade.

The preceding description of vertical facial growth shows a striking agreement in its time schedule with that advanced by Hellman[5] whose obser-

vations included the entire facial height. I have devoted attention in my study merely to that part of the face lying between the root of the nose (nasion) and the gum margin of the upper jaw (prosthion). This is of course little more than half the adult facial height from nasion to point of chin (gnathion). The very considerable component in growth of permanent teeth and mandible finds no place in my description. Such accounts as that to which I have referred will naturally give a slightly different interpretation of the growth picture, yet each interpretation is correct so far as it goes.

SUMMARY UPON GROWTH CHANGES OF THE FACIAL MASK

A brief recapitulation of the preceding pages serves to fix in mind the observations recorded.

A telltale vascularity of bone indicates an area where growth or modification of form is in active progress. It is the same kind of vascularity which is present with erosion and callus formation in healing fracture or repair of the bone wound in an amputation stump, but in these surgical conditions the process is both more obvious and less orderly.

Applying the criterion of vascularity to the palate we find active growth with increase in dimensions after infancy almost confined to the palatal processes of the maxillae which, in their forward and backward growth, envelop the palatal processes of premaxillary and palatal bones. The maximum palatal breadth, which naturally occurs at the level of the first molar teeth, the largest of the molars in Man, follows full development of these teeth. This means that approximate maximum palatal breadth is reached between four and five years. Of course one does not include in this statement intercanine width. The large permanent canines require far more space than the corresponding milk teeth, and this extra space is provided by the anterior maxillary horns which envelop the premaxillary bones. Maximum intercanine breadth is not attained therefore until about twelve years.

For the study of facial growth either in vertical or anteroposterior direction an American Negro series is more serviceable than a White group because of the greater uniformity in the detailed relationship of facial mask with cranium. It is also advisable to orient the skulls so that we superpose, or make our measurements of vertical facial height from the root of the nose (nasion). Usually skulls are oriented in the Frankfort plane, which makes the lowest point on the inferior orbital margin (orbitale or orbital point) the center of measurement. Since, in the growing child, the orbit extends downward with facial growth, orientation in the Frankfort plane exaggerates the part played by the lower face, including the mandible, in vertical growth.

Between the nasion and the upper gum margin between the incisors (prosthion) vertical growth of the face is largely but not entirely respiratory. It progresses by spurts, the maxima occurring during the first six months, the third and fourth years, from seven to eleven years and between sixteen and nineteen years. The last mentioned is partly sexual, and this sexual growth, largely in the mandible, continues for a while in early adult life.

In anteroposterior growth the presiding influence is dental. After space is obtained for accommodation of the deciduous dentition, there is still need

for placement of the three permanent molars. In this direction we also find growth occurring in spurts. The space for the deciduous teeth is attained in the first six months. There is then a pause with renewed growth between four and seven years to accommodate the first molar. The growing second molar is partly accommodated in this spurt, but space is completed during the ensuing years though no further marked growth occurs until that for the third molar between sixteen and nineteen years.

It is a little difficult to understand at first how this space is obtained in the hinder part of the upper jaw. When it is observed, however, that the face is so hafted to the cranium that the forwardly expanding brain case carries the facial mask with it and hence increases the available space, ventral to the vertebral column, one can realize how this accommodation is provided. With the absence of any necessity for forward growth at the premaxillary-maxillary junction this suture in Man closes even in early infancy.

Anteroposterior growth in the Gorilla is studied by way of contrast. In this animal space for the hinder teeth of the deciduous dentition is attained through the carrying forward of the facial mask by the forwardly expanding brain case precisely as in Man. But there the uniformity of pattern ceases. The Gorilla brain case fails to progress any further, and the extra space required for the permanent molars is attained by a sliding forward of the jaws from beneath the brain case with increasing prognathism. Completion of this process occurs only when space has been provided for the third molar.

II. MANDIBULAR ADJUSTMENT IN FACIAL GROWTH

Having now considered the main phenomena in maxillary growth, it is necessary to review those features of mandibular growth and adjustment which are related thereto. It is not my purpose to make a thorough onslaught upon the problem of mandibular growth which is one of the most elusive though important of all skeletal problems. There is as yet no method devised whereby its growth activity can be recognized and registered. Much further investigation is still needed, and new methods must be sought before this problem yields its full story. It is quite clear, however, that since the mandible, shaped like the letter L, encompasses, by its two limbs, the developing maxilla with its premaxillary and palatal bone annexes, vertical growth in the latter must be paralleled by growth in the mandibular ramus and anteroposterior growth by extension of the mandibular body. The well-recognized changes in form at the region of the angle are part of this adjustment. Impulses of growth are not always accurately adjusted, and defects are manifest in various degrees of disharmony.

Failure of mandibular body to keep pace in anteroposterior growth means an overshot jaw, a receding chin or perhaps impacted lower third molars. If the defect in horizontal growth lie in the maxilla there is an undershot jaw, a prominent chin or perhaps impacted upper last molars. Disharmony of vertical growth of maxilla and mandibular ramus calls for adjustments in occlusion and accounts in part for variations in the temporomandibular joint which must now be considered in some detail.

THE TEMPORO-MANDIBULAR JOINT OF CARNIVORES

By a curious illogical unreason we have come to accept the temporo-mandibular articulation in Man as a modified ginglymus or hinge-joint. There is, of course, that grain of truth in the thought which, as in so many scientific problems, springs into a vigorous growth of erroneous interpretation in the fertile soil of misconception. The question which I wish to raise is that ever present one of examining the basal facts of our philosophy to be sure we have interpreted them aright. In the problem of the human mandibular condyle I am sure we have not, but since the very fabric of our misinterpretation undoubtedly presents an interwoven pattern of truth we cannot destroy the fabric without effacing the pattern and are apt to forget that the same pattern may be woven again into a more durable fabric. The reader must then follow the argument to the end before judging its probable accuracy.

Fig. 6.—Left lateral view of Lion's skull, W.R.U. Felis leo, male, B1292, British East Africa. Note the definite association of pre-glenoid process (articular eminence sic!), glenoid cavity and post-glenoid process to form a tubular groove in which the spindle-shaped condyle closely fits. The condyle lies on the occlusal plane.

In Carnivores there is no question of the ginglymus nature of the joint. The transversely elongated spindle-like condyles are held in grooves of corresponding shape in the skull so securely that in certain animals of this Order it is impossible to disarticulate the mandible from the skull without injury even after maceration. The trough-form of glenoid cavity in Carnivores is produced by the development of articular eminence and post-glenoid process into very marked delimiting lips. We have no difficulty in visualizing the post-glenoid process because there is a similar though much less pronounced structure of the same name in Man. We have no difficulty either in adjusting our minds to a glenoid cavity, for it is the trough-like Carnivore glenoid which is our philosophic prototype. As a matter of fact we have transferred to Man the concept of post-glenoid process and glenoid cavity with their functional relationship obtained from the study of the Dog.

It is when we consider the so-called articular eminence that we begin to lose grasp of the situation. There is no question of an eminentia articularis in Man and, with a stretch of the imagination, its homologue can be identified in the Dog or the Bear. In certain other Families of Carnivora, Cats for instance, it is an act of faith to discover an articular eminence. There is instead a pre-glenoid process, its homologue and representative but not its functional equivalent. It is well, at this stage of discussion, to emphasize the practical independence of each of the three features, the pre-glenoid area, eminence or process, the glenoid cavity or surface, and the post-glenoid process. In Carnivores (Fig. 6) the three are so closely related to form so obviously a single anatomical unit, a groove with its lips, that our minds become imbued with an impression that this close relationship is fundamental and that all other patterns must be modifications of this one. Now, in all Carnivores where

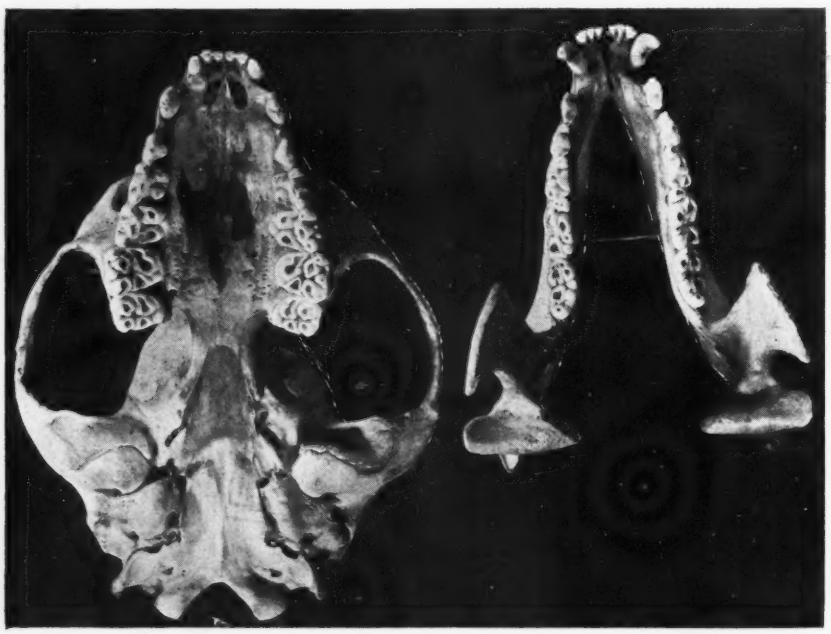


Fig. 7.—Temporo-mandibular surfaces in skull of Panda. W.R.U. Aelurus fulgens B254. Himalayas. Note the definite though modified Carnivore features of this articulation in spite of the fact that the animal has foregone a flesh diet for one of vegetation.

there is a characteristic flesh diet the condyle lies on the level of the occlusal plane, and even in carrion feeders like the Dog which will relish a more varied diet, the condyle practically maintains this level. It is only in such aberrant forms as the Panda (Fig. 7) modified raccoon, which has entirely forsaken the flesh diet, that we find an elongated ramus. Even in this creature, however, the Carnivore origin of the glenoid cavity is still perfectly obvious.

There is one other lesson to be learned before we leave the Carnivore articulation. The changes consequent upon arthritis often give us very significant information upon functional action and area. Fig. 8 shows the condyles and glenoid cavities in a young Tigress with osteomalacia of the skull involving particularly the condyles. Since there is but one form of move-

ment possible in the Carnivore articulation, namely, rotation round a transverse horizontal axis, even the arthritic condyle maintains its original form.

THE ANTHROPOID ARTICULATION

It would be wearisome and is not necessary to set forth a complete account of the Primate articulation, but a little study of the Anthropoid will be quite profitable. While it is probably true that all Mammalia have a common origin, segregation into Primates and Non-primates took place very

Fig. 8.—Temporo-mandibular surfaces in skull of Tiger. W.R.U. Felis tigris, female, B1294. Deciduous dentition. Osteomalacic arthritis of both joint surfaces but especially of condyles, the shape of which is not changed in consequence of limitation in range of movement in the condyle to rotation round a horizontal transverse axis.

early. To think in terms of a close relationship between Primates, which include Lemurs, Monkeys, Apes, Anthropoids and Man, on the one hand and other mammals on the other, is very apt to mislead one. The life patterns in form and habit are so different between the Primates and the Non-primates that reasoning from one to the other is often quite fallacious. Without any attempt, therefore, at a forced comparison of anatomical features we may describe the Primate joint in practically the terms used for the Carnivore.

Though by no means intermediate between the conditions in Man and in

other Anthropoids it is advantageous for the mental exercise to consider first the Orang. Fig. 9 shows a pattern of Orang joint which is very helpful in dissociating the glenoid features. There is a well-marked post-glenoid process. The characteristic eminentia articularis of the Primates is very strikingly developed. There is no vestige of a glenoid cavity or even a glenoid surface except a slight, shallow and imperfect groove between eminence and process. The mandibular condyles of this skull are, as one would expect, somewhat flattened and irregularly oval in contour with the antero-posterior diameter but little less than the transverse.

Fig. 9.—Temporo-mandibular articular area in Orang. W.R.U. Pongo pygmaeus Hoppius, male, B1444. Note the large articular eminence and prominent post-glenoid process with no glenoid cavity or area between.

I have previously mentioned, in passing, the essential difference between Man and the Anthropoids in attaining space for development of dental arches. In both, the brain case grows forward until about four human years, carrying the facial mask with it and thus opening space between mask and pharynx for the development of the dental arches to accommodate the deciduous teeth. Thereafter the human brain case continues to develop forward and thus, in carrying the mask with it, provides space for the dental arches accommodating the permanent teeth. But forward progress of brain case and mask ceases at four human years in the Anthropoid, and from that date onward dental

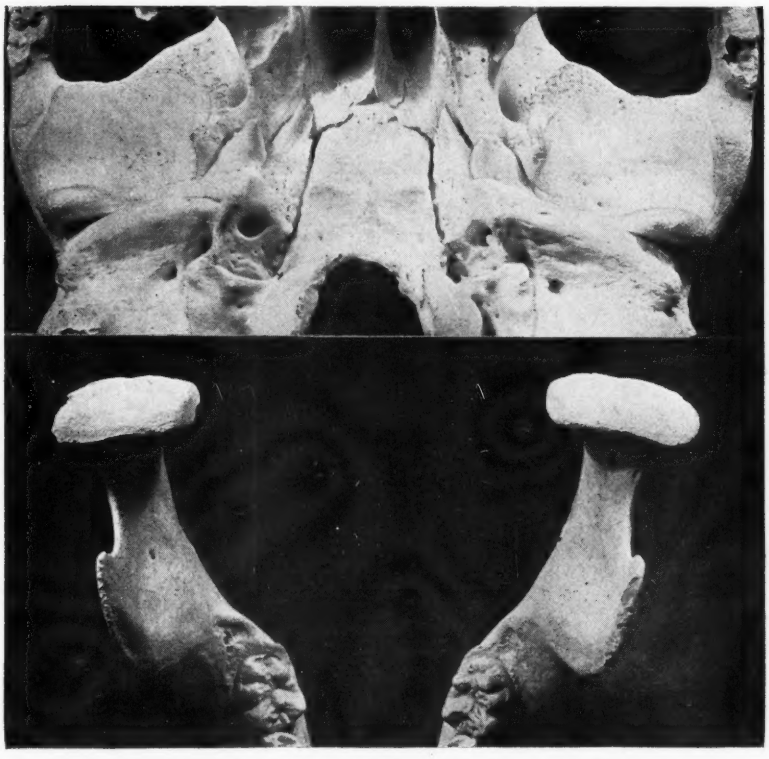


Fig. 10.—Temporo-mandibular articular area in Gorilla. W.R.U. Gorilla gorilla Wyman, female, B1075. The form of the articular area in this long-base skull approximates that of the Orang.

Fig. 11.—Temporo-mandibular articular area in Gorilla. W.R.U. Gorilla gorilla Wyman, female, B1399. A transverse groove, the glenoid surface, appears between eminence and post-glenoid process in this short-base skull.

arch space must be attained by forward growth of the infra-orbital face. Associated with the mechanism of facial growth in the Anthropoid is a relatively long and flat base to the brain case in contradistinction to the short and angular base of Man.

The large canines or dental guides in Orang, as in Gorilla, prevent any appreciable lateral movement at the front of the dental arches. Antero-posterior movements and lateral molar movements, circumferential to a point not far behind the incisors, are quite possible and the occlusal facets demonstrate their existence. The dental guides being present only in the males, do not give an adequate explanation of the facts. The precise type of masticatory movements must occur whether or not dental guides be present.

Fig. 12.—Right temporo-mandibular joint seen obliquely from medial aspect. Chimpanzee. W.R.U. Pan sp. female, B1703. Note the unexpected roominess of the joint cavity.

Figs. 10 and 11 show the difference in articular area commonly occurring in the Gorilla. How far the association of long and short base with shallow and deeper glenoid surfaces should be pressed is beyond our present purpose. This is adequately served if we call attention to the individual differences which are not particularly closely associated with comparable condylar forms. The same differences in glenoid conformation are to be observed in the Chimpanzee as well as in the Gorilla.

If one examines the articular cartilage in the great Anthropoids, it is found to be coterminous with the margins of articular eminence. It has a sharp border and does not extend into the glenoid surface if there be one, even if that surface is concave. However, synovial membrane does cover the

glenoid surface. This extension of synovial membrane into any space between eminence and post-glenoid process is really quite significant. The temporo-mandibular joint is a large and roomy cavity with a loose capsule and great freedom of movement for the condyle which lies within it. In the Anthropoid the important dental feature is occlusion of teeth for triturition, and the condyles act merely as anchors which permit considerable dragging. This roominess of space for the condyle within the joint is well seen in Fig. 12, an oblique view of the right condyle and capsule in a Chimpanzee fresh from the Cameroun bush.

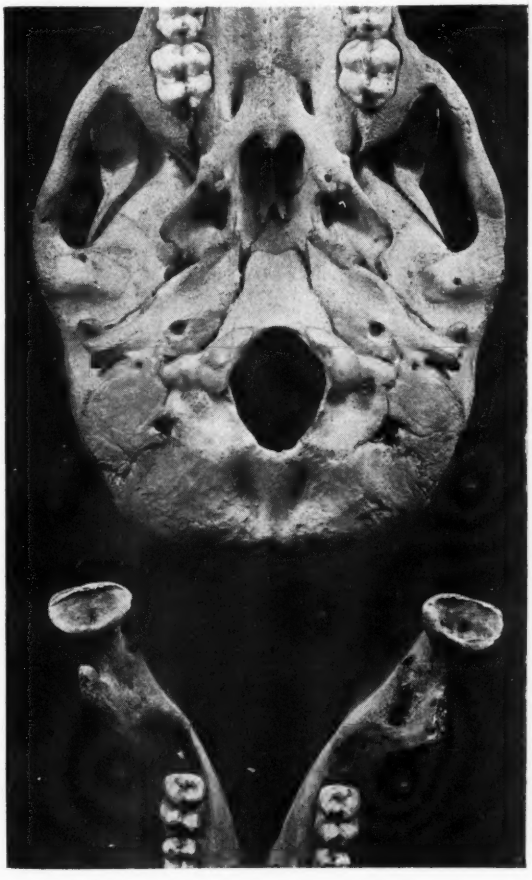


Fig. 13.—Temporo-mandibular articulation in Osteomalacia. Macaque. W.R.U. Pithecus sp. B154. Mixed deciduous and permanent dentitions. Note flat and hollowed condyles with some involvement of glenoid surfaces. The flattened condyle demonstrates absence of snapping or hinge movements.

Inquiry as to what evidence can be obtained from arthritic examples upon the problem of temporo-mandibular movements in Primates requires but little attention, for it is self-evident that the only movements possible are those already outlined. The snapping action of the jaws associated with the long narrow muzzle of Carnivores is unthinkable in Anthropoids. Could it be present it would of course call for fixed condyles which we know do not exist in Anthropoids. Figs. 13 and 14 taken from Old World Apes illustrate better than a description, the flattening of the condyle and excavation of the articular eminence in arthritis.

THE HUMAN TEMPORO-MANDIBULAR ARTICULATION

In the light of data just presented upon the Anthropoid joint we may review certain obvious features of human anatomy, of which the significance, estimated against a background supplied by the Carnivores rather than the Anthropoids, has scarcely received proper appreciation. If one examines the articular cartilages of the human joint, the same clear definition of margin is evident at the front of the articular eminence and the front of the condyle. Again, as in the Anthropoids, the cartilage fades out on the back of the condyle. Behind the articular eminence on the ventral slope of the glenoid

Fig. 14.—Temporo-mandibular articulation in Arthritis. Baboon. W.R.U. Papio hamadryas Linnaeus. male adult, B1025. Note congenital defect of right condyle. Arthritic flattening of left condyle with involvement of articular eminence but not of glenoid area.

cavity it also fades out. While this is true of Anthropoids in a degree, it would be more accurate to say of them that the articular cartilage shows a clear delimitation at the back of the articular eminence when there is no excavated glenoid, but when the glenoid is concave the articular cartilage thins to a termination on its forward slope. It is evident that in Man, it is the articular eminence rather than the glenoid, and the forward slope of the condyle which are the actively functioning parts of the joint surfaces.

Now it is perfectly well recognized that the human condylar and temporal articular contours are not reciprocal in shape. And it is also correctly held that the inter-articular fibro-cartilage adjusts its shape to the dissimilar

contours of the joint surfaces above and below. Further, this inter-articular fibro-cartilage certainly enters the glenoid fossa and is attached in front to fibers of the external pterygoid. When, therefore, this muscle contracts, it is supposed to draw the inter-articular cartilage forward with the condyle, but it is difficult to see how the cartilage could be otherwise acted upon than to steady it on the articular eminence and stabilize the contact of the forward condylar surface with the inter-articular cartilage. If one watches the movements of the condyle on the roentgenoscope, it is quite evident that opening of the mouth can take place without any forward and downward displacement of the condyle, but it is also evident that this does not occur without definite effort. Unless instructed to move the jaw in this particular

Fig. 15.—Example of deep glenoid areas with high condyles. W.R.U. 1054, male, Negro, twenty-one years old.

manner the subject under observation will, on opening his mouth slowly, just drop the mandible slightly so that there is an appreciable interval between upper and lower occlusal surfaces during which movement the condyle can be seen to slip downward and forward. Then rotation of the condyle takes place with opening of the mouth. It is only in the actual rotation of the condyle that the condylar articulation becomes effective, condyle and ramus acting as a strut. In the regular masticatory movements when the occlusal surfaces are in contact, the condyle plays no active part and acts merely as a dragging anchor. The actual height of the cartilage-coated condyle, like the glenoid depth, is determined by factors in skull development quite apart from those of opening the mouth or of mastication.

Figs. 15 and 16 show the variation which occurs in these features. Man is certainly far more variable than the Anthropoids in the form of his temporo-mandibular joint and its constituent parts. The comparison indeed illustrates a biological axiom which receives less attention than it deserves, namely, that form does not slavishly follow function. Each of us does the best he can with the bodily equipment which he possesses, and usually the accomplishment exceeds the promise of the form, even to the discounting of an obvious defect. The movement at any joint is a specific problem for each individual, and the action is stereotyped only by the limitations of articular locking. Details of muscular action vary with the individual. In mastica-

Fig. 16.—Example of shallow glenoid areas with low condyles. W.R.U. 1582, male, White, forty-four years old.

tion the temporo-mandibular joint is almost negligible, and the problem is one of adjustment between muscular action and dental occlusion. Consequently we must expect unending variety in what one might term behavior patterns of jaw movement.

A good example of the skid-like relationship of the forward glenoid curvature to the condyle is given in Fig. 17. In this defective dentition occlusal wear has produced reciprocally oblique surfaces on lower first molar and on upper second premolar and first molar. Figs. 18 and 19 show admirably a forwardly placed condyle on the articular eminence, not in temporary position, but in a permanent relationship enforced by the shortness of the mandibular body. The lengths of mandibular body, ramus and condyle and

Fig. 17.—Demonstration of skid relationship of condyle on forward slope of glenoid area. W.R.U. 1188. male, White, seventy years old. Left lateral view. Note oblique wear of upper second premolar and first molar and of lower first molar. The condyle obviously slides up and down on the skid formed by the forward slope of the glenoid area.

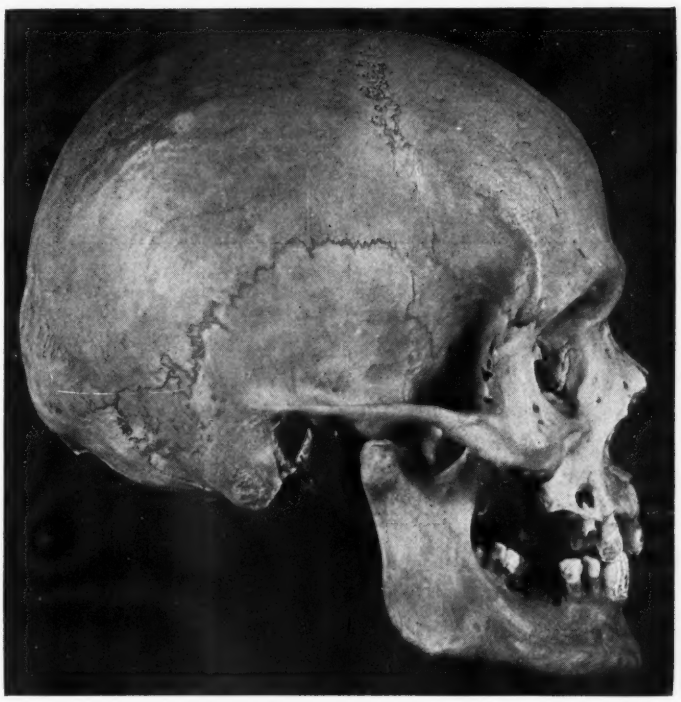


Fig. 18.—Example of permanent condylar-eminentia relationship. W.R.U. 983. male. White, forty years old. Right lateral view. The mandibular body is so short that although the upper incisors overlap the lower teeth, the condyle articulates inevitably with the articular eminence.

size of the mandibular angle are all features for mutual adjustment with maxillary form in facial pattern.

As in Apes, arthritis of the temporo-mandibular articulation betrays the precise details in actual bony relationship and in movement. The flattening of the condyle and erosion, not of the glenoid area but of the articular eminence, are too well known to require presentation here. Tracings of lateral roentgenograms made after instructing the subject to swallow in order to settle his teeth into occlusion likewise demonstrate the very varied relationship of the condyle to the forward glenoid curve or the articular eminence.

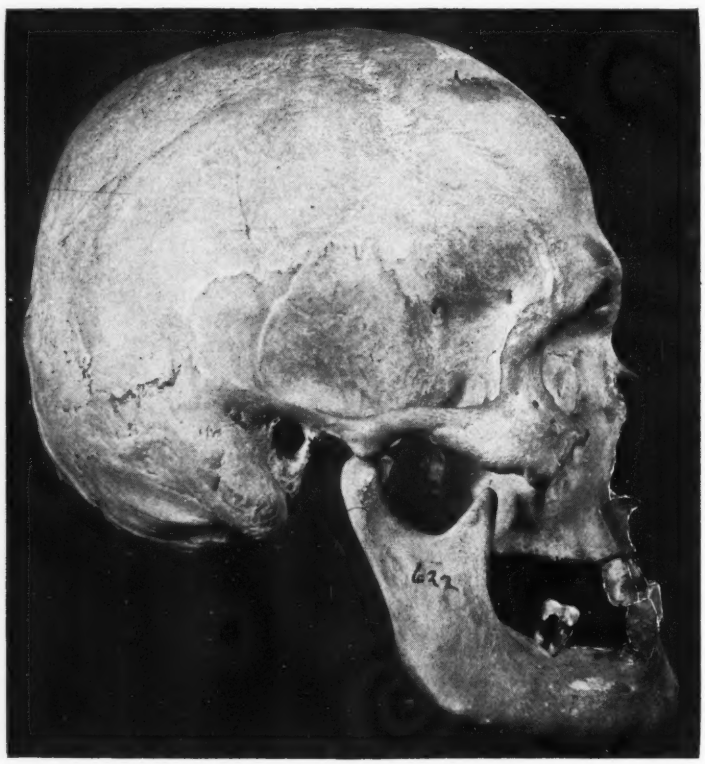


Fig. 19.—Example of permanent condylar-eminentia relationship. W.R.U. 622, male, White, thirty-five years old. Right lateral view. Mandibular body short; left lower incisors protruding. Permanent forward position of condyle antedates dental defects.

SUMMARY UPON MANDIBULAR ADJUSTMENT IN FACIAL GROWTH

Mandibular growth is elusive in our study because no satisfactory method has yet been devised for its registration.

The mandible, with its two limbs, the body and the ramus, encompasses the maxilla with its annexes, the premaxilla and palate bone, but vertical growth in the maxillary complex may not be exactly paralleled by ramus growth, and likewise its horizontal growth may be disharmonic with growth of mandibular body. If the defect be in the mandibular body, we shall meet an overshot jaw, a receding chin and perhaps impacted lower third molars or a permanently forward position of the condyle on the articular eminence. If the defect be in the ramus, there is a modification of the temporo-mandibular joint.

This joint is usually thought of as a modified hinge-joint such as occurs in the Dog. The human joint is, however, built upon a quite different plan, namely that of the Anthropoids. A comparison of the joint in these animals with that of the Dog shows that there is no necessary relationship between glenoid area or cavity, post-glenoid process and eminentia articularis. In the Orang the eminence and the post-glenoid process are present but no glenoid. In Gorilla and Chimpanzee the glenoid is present but varies in extent and depth. In Man it is always present and comparatively deep, though it varies greatly in the extent of its depth.

The Carnivore joint is essentially a hinge for use with snapping jaws. The Anthropoid articulation is essentially a gliding joint for use with triturating molars. The former has a spindle-shaped condyle securely locked in a tubular groove with prominent marginal lips. The latter has a mushroom-like condyle gliding over a flat surface. The human joint is a modification of the latter, but the flat temporal surface is transformed into a skid up and down the slope of which the elongated condyle travels. Superficially, but only superficially, in consequence of its movement upon a slope rather than upon a flat surface, the human condyle resembles the Carnivore condyle. The sharply defined ventral limit to and gradual dorsal tapering of the condylar articular cartilage sufficiently differentiate it from the Carnivore type and emphasize the significance of its ventral surface in articulation with the forward glenoid curve. This relationship can be clearly seen on lateral roentgenograms with the teeth in occlusion.

In opening the mouth, the condyle with the ramus acts as a strut and is important. In masticatory movements the occlusal surfaces of the teeth are the significant features, and the condyle plays a passive rôle as of a dragging anchor. Mastication is, in its details, an individual problem to be worked out by the muscles in relation to limitation of opportunity by the bony formation. We ought not, in our practice, to reconstruct problematic temporomandibular relationships but concentrate attention upon occlusal surfaces and their reciprocal relationships.

Defects in growth of mandibular body may be responsible for a permanent relationship between condyle and articular eminence but this entails no disability.

Arthritis in Carnivores, Apes and Man, in its location and by the deformation produced, betrays rather definitely the position of the condyle on the temporal articular area and the type of movement characteristic of the joint.

GENERAL SUMMARY

1. Telltale vascularity indicates a site of rapid growth or adjustment.

2. In horizontal facial (palatal) growth the majority takes place in the maxillae of which the forward and backward horns envelop premaxillae and palatal bones respectively.

3. Forward growth of the human brain case carries forward the facial mask and provides hinterspace for the dental arch. In the Gorilla, however, this forward growth ceases at four human years, and thereafter the suborbital face slides forward alone to provide space behind for the dental arch.

4. Spurts of forward growth in jaws are to be noted during the first six months after birth, between four and seven years and again between sixteen and nineteen years. The first spurt develops the deciduous arch; the second provides space for the first molar and, together with slower growth between seven and eleven years, for the second molar. The third and last spurt, which may be in part aborted, provides for the third molar.

5. Vertical growth in the facial mask, largely respiratory in nature, also occurs in spurts of which the first takes place during the six months after birth, the next during the third and fourth years, another from seven to eleven years and the last between sixteen and nineteen years, this one being probably largely sexual. It is to be noted that these spurts involve face between root of nose and upper teeth exclusively. There must not be confusion with observations of others upon the larger area of the face which includes the mandible, for the latter has its own growth patterns.

6. The mandible, by its two limbs, encompasses the maxilla with its adnexa. Defect of growth in mandibular body may result in overshot jaw, receding chin, impacted lower third molar or a permanently forward position of the condyle on the articular eminence. Defective ramal growth is not very significant and merely brings about a modification in position of condyle on the forward slope of the glenoid cavity which is really the hinder part of the articular eminence, upon the inclined slope of which the ventral face of the condyle glides in its masticatory movement.

7. This oblique slope upon which the condyle glides is a kind of skid, and its influence on condylar movement may occasionally be very clearly demonstrated in the wear of the teeth.

8. The human temporo-mandibular articulation is not a modified hinge joint but a gliding joint derived from the anthropoid form. There are in skull growth factors with which we have nothing to do here but which nevertheless modify the anthropoid gliding surface by turning up its dorsal portion into the forward curve of the glenoid fossa, and again by changing the mushroom-like condyle of the Anthropoid into a transversely elongated condyle with a functional ventral face. This face glides upon the obliquely inclined skid of the forward glenoid curve.

9. Arthritis in its location and by its deformation of articular surfaces betrays the sites of articulation and the movements which take place there.

10. In masticatory movements the condyle plays a purely passive part, and the occlusal surfaces are alone significant.

In opening the mouth the condyle with the ramus is an important structure. It acts as a strut. The condyle, perched on forward glenoid curve or articular eminence, gives purchase to the muscles opening the mouth, which action of course in such movements is not dependent upon gravity.

11. The various movements of the jaws cannot be predicted upon any general plan. Every individual will present such particular detailed modification of muscular action as limitations set by the bony parts demand. In our practical application of the foregoing information we should concentrate attention upon occlusal surfaces rather than on temporomandibular joint.

REFERENCES

1. Barber, C. G.: Immediate and Eventual Features of Healing in Amputated Bones, Ann. Surg. **90**: 985, 1929.
2. —: The Detailed Changes Characteristic of Healing Bone in Amputation Stumps, J. Bone and Joint Surgery **12**: 353, 1930.
3. Bowman, H. A.: Unpublished Investigations.
4. Hellman, M.: Changes in the Human Face Brought About by Development, INTERNAT. J. ORTHODONT. ORAL SURG. & RADIOG. **13**: 475, 1927.
5. —: The Face and Teeth of Man, J. Dental Research **9**: 179, 1929.
6. Krogman, W. M.: Studies in Growth Changes in the Skull and Face of Anthropoids. II. Ectocranial and Endocranial Suture Closure in Anthropoids and Old World Apes, Am. J. Anat., in press.
7. Todd, T. W.: Recent Studies in the Development of the Face, INTERNAT. J. ORTHODONT. ORAL SURG. & RADIOG. **15**: 1157, 1929.
8. —, and Iler, H. D.: The Phenomena of Early Stages in Bone Repair, Ann. Surg. **86**: 715, 1927.
9. —: The Anatomical Features of Epiphysial Union, Child Development **1**: 186, 1930.
10. —: The Roentgenographic Appraisement of Skeletal Differentiation, Child Development, in press.
11. —: Differential Skeletal Maturation in Relation to Sex, Race, Variability, and Disease, Child Development, in press.
12. —: Comparative Youth, Child Development **1**: 79, 1930.
13. —, and Tracy, B.: Racial Features of the American Negro Cranium, Am. Jour. Phys. Anthropol, in press.

DISCUSSION

Dr. S. J. Lewis, Detroit, Michigan.—It is not my intention to discuss this most enlightening talk, but I would like to ask Dr. Todd a question. In the opening part of your talk you said that some of your colleagues had been studying the changes in maxillary breadth during growth, and had informed you that the upper dental arch reaches its maximum breadth by the fourth or fifth year. Is that correct, Dr. Todd?

Dr. Todd.—Yes and no. It is exactly what I said. When you say that the arch reaches its maximum breadth, you have to remember that of course at that stage the arch is like that [indicating a broadening out], whereas in the adult it is like that [indicating a lengthening]. If you take the maximum breadth between the tips of my fingers, that corresponds to the wide part of the adult. Although you may get a millimeter or so more than that by the age of sixteen, it is so very little that one would have to say there is practically no growth from actual breadth compared with the growth in length after the age of four or five.

Dr. Lewis.—I think you are right in one respect, Dr. Todd, but it seems to me that you have taken only one component into consideration: the premolar area. Those of us who have been observing children from the age of two to nine years, making models of their teeth and dental arches, and measuring the width changes by accepted standards, have agreed that there is a definite increase in the width of the dental arch in order to accommodate the larger permanent teeth; that is, from canine to canine. We do realize, however, that in the premolar area there is very little increase in width, perhaps not more than a millimeter or two, after the age of five or six. But the increase in the canine width is quite marked; in our series it is approximately six millimeters between the ages of two and eight years. If this does happen—and we are sure that it does—then, contrary to what you have said, there must be a marked increase in the breadth of the dental arch after the age of four or five years.

Dr. Todd.—It is only just a chap like you, who realizes that what we are after is a proper presentation of all the features of the case, that would so delightfully come up and say, "Are you not quite wrong?" because that is really what it amounts to. That is exactly the sort of discussion I want.

Let us see where the agreement really is, and where the points of disagreement are. We speak of the premolar area. All right. The premolar area in the adult is the milk molar area of the child. That is the part to which I am referring.

About the canine, you are quite right. The canine area does increase tremendously because of the necessity of accommodating these larger teeth, and the whole side of the mouth becomes squarer.

How can that undoubted truth be brought into alignment with the other? In the earlier part of my talk, I passed very quickly over some of the work that I had presented before, and then mentioned that the growth was in the maxillary element which had two horns sticking up encircling the premaxilla, and two horns sticking down encircling the palate. That growth in length occurred in the two legs around the palate, straddling the palate and providing enough space for the molars. These two horns going up and straddling around the premaxilla provided space for the canines. All that additional space for the canines, to which you very properly draw attention, is obtained without a definite relationship to the suture between the premaxilla and the maxilla. So you are absolutely right. The canine area is increased, but in the speed with which I passed over those earlier stages I did not take enough time to point out the effect of those horns which were straddling around the premaxilla.

Dr. Lewis.—I think, now, we are in agreement.

Dr. Todd.—I do hope the other folk will ask the same sort of penetrating questions.

Dr. Harry E. Kelsey, Baltimore, Md.—I should like to ask, and I should like Dr. Lewis's opinion as well as yours, if the age of four years is not too early to get that maximum, and does not that expansion in the canine take place with the expansion of the whole arch up to about the age of five or six so that it is not a separate expansion in the canine region, but if the arch expands normally you find separation from the permanent teeth has occurred by the time the arch has assumed its greatest width? That is, the deciduous dentition. It seems to me that four years is early for the arch to have reached that. You know better, and so does Dr. Todd. I know the amount of work you have done in infant dentitions.

In the normal arch, is not that early for the arch to have attained its greatest width?

Dr. Lewis.—The observations on the width growth of the dental arch that Dr. Lehman and I made during the past five years seem to corroborate Dr. Todd's statement that at four or five years the maximum breadth of the arch in the premolar region is reached; that is, approximately. The spaces that we hear orthodontists speak of do not always appear at four or five years of age. We have found in many cases that spacing and alignment of the incisors have no relationship whatsoever. That is, as the incisors come up through the alveolar process, there is a growth process going on, and proper alignment takes place sometimes whether there is a spacing of the deciduous incisors or not.

I will say, however, that we do find deciduous arches with large spaces between the incisors at four years; at three and earlier in fact. They are there all the time but are not associated with growth changes. In other cases we find spaces occurring during the growth period, but not as early as four years of age, as Bogue, in his work, would have us believe. We have found that the greatest increases in width between the canines comes after six years of age, and sometimes continues until as late as the tenth year. Bogue said that if these growth spaces do not appear by the fifth year, the arch should be widened. Our observations do not confirm this view.

Our studies point to the conclusion that the maximum width of the dental arch in the premolar region is approximately reached by four or five years of age. I think Dr. Todd will agree to that.

Dr. G. W. Grieve, Toronto, Ontario.—I should like to ask a question of Dr. Todd. We all recognize, or most of us, the fact that in some of our cases which we present for treatment the mandible is what I might call short. I have advocated the procedure on that type of case of jumping the bite, if you like, making the appliances of such a nature that each time the patient closes his teeth together the mandible is brought forward so that the teeth are in their normal mesiodistal relation. Of course, that construction is such that when the teeth are dropped apart the mandible drops into its normal relation with the glenoid fossa. I should like to ask Dr. Todd what he thinks of that procedure and what probably

takes place, whether we are taking any chance of any difficulty in the mandibular articulation with the glenoid cavity.

I feel satisfied that with the method of treatment I have advocated we get an actual lengthening of the mandible in the course of six months to a year depending upon the age of the patient. Where in the original the patient closes the teeth together, the mandibular teeth are probably several millimeters distal to the maxillary teeth. After the removal of these appliances, growth has apparently taken place or a change has taken place whereby the patient is not able to occlude the mandible in that distal position.

Dr. Todd.—I always regard the mandible as a sort of will-o'-the-wisp, and I marvel at the way in which the orthodontist has shown us the growth there in the mandible without reference to such things as sagittal planes, and all the other things that we hear about.

The mandible does change. It took me a long time to believe that because I still was bound by the old ideas. You know the old story, but you have long grown out of it. The orthodontists do such wonderful things with the mandible that I am perfectly prepared to believe that there is growth in the mandible brought about by such a procedure as you suggested.

I am not at all concerned about the possible dislocation of the condyle out of the glenoid because I do not think nature pays very much attention to that. I think the glenoid fossa is a kind of head-space to enable the condyle to slide up on the articular eminence.

As to the technical details, of course I am not an orthodontist and, in such a discussion, I have that inferiority complex which every man must have who is not specially trained in that particular mechanical art. As far as the principle is concerned, I would say more power to you.

Dr. C. C. Howard, Atlanta, Ga.—I do not see how I could ask Dr. Todd one question; I could ask him fifty questions.

At the same time, the part of his presentation that appealed to me was the fact that only yesterday I told you that the greatest increase in face length occurred between eleven and fourteen or fifteen, and I referred to Hellman's work which showed that very thing. Now my friend Todd says that the increase is from seven to eleven and that from eleven to sixteen is slight compared with the other. Just what does that mean?

More than that, Dr. Todd, if I understood him correctly, said he was correlating, so to speak, the growth of the body. He spoke of the increase in blood, the increase of the muscle with that of the skeletal make-up of the head, face, and jaw. He says the growth between these ages is infinitesimal. Maybe he meant that by comparison. If he did not and meant to infer it was actually very slight, he did not correlate body growth with vertical jaw growth. He would have to admit that.

Further than that, when he stated that this increase was infinitesimal—maybe I have him all wrong—between these ages, he would also have to admit that at prepubescence and pubescence, and immediately postpubescence, we do get by common observation a tremendous increase in vertical height.

I probably should have talked to him in his room. Maybe I misunderstood all this. Maybe somebody else understood it like I did. Straighten us out.

Dr. Todd.—Thanks, Dr. Howard. I know now, what with Dr. Lewis and Dr. Howard, that we are colleagues working together on a common problem. The directness, the delicious directness, of attack in these matters is very gratifying to me. Of course you are absolutely right.

When I was speaking of vertical growth, I was referring solely to that part of the face between roof of the nose and the upper teeth. When you speak of the vertical growth, you are referring to that between the roof of the nose and chin. It is the mandible which accounts for the difference between our statements.

When a youngster about eight years old begins to feel he is really a little man and is beginning to learn by his own experience and the hard knocks he gets, you see that little mandible of his growing. The mandibular part of the face does indeed grow in vertical

height between eleven and sixteen years exactly as you say. I was speaking simply of the growth between nasion and prosthion and not of growth in the entire face.

The baby at birth doubles its height and quadruples its weight during the first year. That is perfectly enormous growth in body bulk. At no period in life does ever such an enormous increase of bulk occur later. Dr. Howard is perfectly right in saying there is a very considerable growth of the entire face between eleven and fifteen years. I happen to take the upper face; Dr. Howard happens to take the entire face. Both versions are perfectly true. It is only when we have such a congenial spirit of mutual understanding that we reach common ground in interpretation. Each is right for the particular area to which he refers.

There is another thing which I have not specially emphasized, namely the enormous development of the lower chamber of the nose after the eighth year. Curiously enough, the inferior turbinate hardly comes into action at all until between the ages of seven and eleven years. The lower part of the nose then balloons out to take care of the respiratory expansion necessary for the increase in body bulk that you are speaking of.

Dr. F. M. Casto, Cleveland, Ohio.—You spoke of the anteroposterior growth. Is that taking place between twenty-one months and seven years, and a relatively small amount between seven years and sixteen? That may be confused with vertical growth.

Dr. Todd.—In facial growth we have to remember vertical, anteroposterior, and transverse diameters. The transverse diameter of the palate and the transverse diameter of the nose are quite different. We cannot take this diameter as any indication of the diameter of the jaw.

Dr. Casto.—The point is that the anteroposterior growth takes place one time, while the transverse takes place at another.

Dr. Todd.—There is an early anteroposterior growth for the accommodation of the deciduous arch, and a later growth for the accommodation of the permanent molars. So between seven years and sixteen years the anteroposterior growth is relatively small. It is about, in absolute terms, a half or rather less than a half of that growth between four and seven. Vertical growth is another matter altogether.

Dr. C. C. Howard, Atlanta, Ga.—Yesterday I made the statement that in my opinion the greatest potential value to orthodontia would come about through knowing more about the growing individual. That is what I said. I do not know whether that is true or not.

Appreciating the variability of growth, appreciating the acceleration of growth in a given area of a bone, and appreciating the general acceleration throughout the skeleton in its relation to that particular area and to the bone, what encouragement would you give us as far as ever being able to correlate one part of the body to the other? It seems to me to be a mass of question marks.

Dr. Todd.—I would love very much to give Dr. Howard some comfort because I have some of my greatest inspiration and a great deal of my comfort from the work of Dr. Howard himself.

It is an extraordinary thing that we really grow up so symmetrically. It is an extraordinary thing that we really grow up to resemble our own parents and not somebody's else.

In growth there are all sorts of handicaps, and a handicap which hits us in one place may not hit us in others. It is the modifications resulting from these handicaps that we call variations. I had to expunge from my mind the idea of a natural variation because I found that was a philosophic pitfall. If I sit down and say, "Oh, yes, it is natural for one individual to vary from another," then I stultify my thought. I must say, "Why does that individual differ from the other?" When we are working over the growing child, watching his progress from year to year, we are actually watching the influence of his handicaps.

There are some handicaps, like measles, for example, that sweep with cyclonic effect over the whole body and repress or retard growth for a certain time. In those particular parts of the body that were specially vulnerable at the moment the cyclone hit the body, the effect is greatest. In looking over the x-ray picture of the entire skeleton, one can pick

out a specific area and say, "Here is where the cyclone hit." As we watch the progress of development of that child, we can see how it recovers, but, of course, the speed of recovery will vary with the amount of damage done.

Dr. S. J. Lewis, Detroit, Mich.—I should like to ask Dr. Todd another question. This is not exactly germane to the subject, yet I should like to have an answer to this if Dr. Todd can give it to us because I think maybe all of us would like to have this point cleared up.

As we speak of growth, we think of addition of mass or increase in the number of cells. That is a conception I have had, I know, for many years. But the psychiatrist comes along and tells us—at least two or three have told me—that our conception is partially wrong, that growth does not always mean addition of mass by the increase in the number of cells but by the increase in the size of the cells themselves, and cites as an example the increase in the size of the brain, saying that the number of cells in the brain does not change from infancy to old age. If that is true, is there some correlation between that type of growth and the type of growth we get in the face?

Dr. Todd.—I am tempted to reply to the psychiatrist, never mind the cells of the brain, but what about the water on the brain?

It is true that we think of growth in terms of increase in dimension. We also ought to think of growth in terms of adjustment. There is no better way to realize that than by observing that while the face grows by increase of dimensions and the brain case grows by increase of dimensions, each is growing in its own way, and there has to be an adjustment at the site of hafting of the face onto the brain case.

Our psychiatrist friend is thinking of adjustment. It seems pretty definite that the number of cells does not increase in the brain between infancy and adult life, but adjustment is constantly occurring, and there is no doubt that though the brain cells do not increase in number they put out more feelers, so to speak, that is, they make more connections.

Dr. Lewis.—Do the cells actually increase in size in the brain?

Dr. Todd.—In manner of speaking, yes. Here is a cell of which the cell-body is in the lumbar region of my spinal cord and the axon or cell-fiber extends down to the sole of my foot. Of course that cell increases in size as I grow from babyhood to adult life, not because the cell-body increases but because of the immense increase in length of the axon or cell-fiber. It is in the extension of the fibers of the cells in the brain and the spinal cord that there is increase in size.

But if you think of adjustment as well as increase in dimensions as an example of growth, I think philosophically you can get around your difficulty.

Dr. F. M. Casto.—Of how much importance is the presence or absence of teeth during the period of development of the jaws?

Dr. Todd.—I think, Dr. Casto, that the presence of teeth is of paramount importance, but I have not any very good evidence except the evidence of those fellows who have extracted all the teeth from growing dogs and checked the jaw growth against that of the normal twins. One has to remember that you cannot extract tooth buds from a jaw without working considerable havoc in the jaw growth mechanism.

Dr. Casto.—When congenitally missing?

Dr. Todd.—I have never had an opportunity of seeing an individual with a really extensive absence of tooth buds. I have heard of toothless children, and I have had visions of being able to run my fingers around the bony gums, but always when I have seen the patients there have been relatively few missing buds.

Dr. Casto.—I have had some showing thirty congenitally missing.

Dr. Todd.—I should like very much to see such x-ray pictures and patients. How do the jaws get along?

Dr. Casto.—Very fine.

Dr. Homer Robison, Hutchison, Kans.—In viewing from the side lines, I am wondering if the difference between Dr. Howard's and Dr. Todd's idea on growth might be due to the different nationality. Is it not true that the maxilla of the Negro develops sooner than the White?

In other words, we know it is true that the nose is low in the infant. As Dr. Todd mentioned, you take the Negro child up to the age of four or five and you can scarcely detect any difference. The nose then begins growing higher and more anteriorly with age. Dr. Howard's observations were on the White race, whereas the ones Dr. Todd showed us were the Negro.

I bring that up as a point because I observed particularly how the nose grows anteriorly in the Whites and not so much in the Negro.

Dr. Todd.—Dr. Robison, I hoped for relief along those lines. I examined the noses of a large number of our White and Colored people, and I found that the distance between nose root and upper teeth is the same. Of this distance, that between nasal root and nasal floor is greater in the White and less in the Negro. The distance between nasal floor and upper teeth is greater in the Negro and less in the White.

Dr. C. B. Mott, Asheville, N. C.—I want to ask Dr. Todd one thing. If we say that these children are retarded in their development, and if they are retarded so that they never reach normal, is there any way we do know that is a fact?

Here is the point I want to bring out, which I want to illustrate by a little story of a man. He went to a hotel, American plan, stayed a week and did not take any meals. When he went down to pay his bill, the clerk charged for the meals during that week. The man said he did not owe it because he did not eat anything. This man, who had a wonderful brain like Dr. Todd, said, "You owe me something."

The clerk said, "We do not owe you anything."

This man, who was a lawyer, said, "Yes, you do. You owe me for legal advice."

"We did not get any legal advice, just like you did not get anything to eat."

He said, "It was there for you; if you did not get it, it is your fault."

We know it is there for us.

Dr. W. W. Woodbury, Halifax, Nova Scotia.—I should like to supplement very briefly the remarks of Dr. Casto.

I think with all honesty and all humility we are entitled, as a Society, to congratulate ourselves a little bit that we have now this sustained interest in such a topic as is before us this morning.

I like that word "hafting." It was not familiar to me until I read some of Dr. Todd's articles. We have got to haft our appliances onto our perceptional growth.

Dr. Hellman told us last year that orthodontics was advancing, but unequally; that from a technical standpoint it had advanced rapidly, and that from the standpoint of understanding and appreciation of growth it had not advanced so rapidly.

Is not there encouragement for us in the work that Dr. Todd and his confreres in Cleveland are doing? It is such a contribution as Dr. Hellman brought before us, the work opening up under Dr. Winternitz at Yale, and the collateral work at Rochester.

I think we can all sense a difference in our direction of interest in the last few years, and to me it has been more than worth while.

Dr. T. Wingate Todd.—All I would have to say in conclusion is this: That it is more than a delight to me to come down and meet with you because I feel the camaraderie of the orthodontists in these problems of growth. I get my greatest inspiration from just such happy discussions as we have had this morning.

I do not ask you to accept all the things as I state them to you. I am very apt to put them in a sort of categorical way in order to trick you into responding so that we may have discussion.

THE ADVANTAGES OF REMOVABLE APPLIANCES*

By Dr. Ch. F. L. Nord, The Hague, Netherlands

AT THE meetings of this Society every year those European dentists who are interested in the field of orthodontia discuss the various problems which are of importance in this branch of our profession.

The most important of all is to my mind the matter treated a few years ago by our secretary, Dr. Lockett, in his paper, "The Problem of Final Results in Adult Life of Treated Cases."

In this paper the fact is stated that a large percentage of these cases, a too large percentage, are failures, and that if we do not succeed in getting a method that will enable us to attain reasonable results in a simple way, the future of orthodontia will be hopeless.

There is no denying that it is of little advantage to orthodontia if only in the capitals of Europe and America there are a few specialists who can successfully treat a small number of children of well-to-do parents.

What we want in the near future are dentists all over the world, capable of helping their little patients to get rid of their deformities.

This necessity is, of course, recognized by many orthodontists, and of late, especially in Bonn, Kantorowizs and Korkhaus favor the lingual arch as a means of giving help to all the children who are in need of orthodontic treatment. But, although I personally believe in the good results that may be obtained by this treatment, I do not think that this method will solve the problem, on account of the fact that it is too difficult, too complicated and too dangerous in the hands of the average general practitioner.

In *Die Fortschritte der Zahnheilkunde* of October, 1928, Herbst mentions the system of the school of Bonn and says that this apparatus will not work well in the hands of most dentists. Not only do I agree with him there, but it means something when a man of the well-known ability of Herbst arrives at such a conclusion.

I therefore want to bring to your attention a method of treatment, which I now have used for more than ten years, which is so simple that it can be used without any danger or difficulty by any dentist, and which gives splendid results.

In the course of years I have asked some of my colleagues to try it, and a few years ago I demonstrated and published this method in Holland. Since then, many of my dental colleagues have been using it and have written or said to me that they are enthusiastic about the results. It was my intention to speak to you about it last year, at our meeting in Brussels, but owing to the clashing of that meeting with the session of the F.D.I. in Cologne, I was obliged to leave for Cologne. It was published in the *Dental Cosmos* of last

*Paper read at the Heidelburg meeting of the European Orthodontological Society.

year, so perhaps some of you may have read it in that paper, and I will now very briefly explain the principles to you.

We all agree that in general it is a great advantage to begin treatment as early as possible, but often we are unable to put in appliances and have to wait till the child is older. I always use a vulcanite expansion plate, which causes no trouble whatever and can be placed in the mouth at any age. I have brought some models so that you can see what results can be obtained in this way.

Of course, I know very well that I am telling you nothing new. On the contrary I am trying to bring back a means of expansion (which was abandoned years ago, when we hoped that in the Angle arch we had something better). But I have found this method so much easier and more logical and safe, that I am of opinion that it is by far the most suitable apparatus for obtaining expansion.

After I began to use removable appliances to attain expansion, the results were so remarkably favorable that I gradually systematized their use, so that at present I am able to make use of them for nearly every case.

At first I had the patient wear the appliances day and night, to be removed only while eating. But as it sometimes happened, friends admired the appliances so much, that they suddenly disappeared, or boys lost them in a fight or in some other way, I decided to let the patient use the appliance only at night, and after eight years of experience, this proved to be entirely satisfactory.

I also was of the opinion that by the use of expansion plates, which did not pull at the teeth or even cause any pressure on the teeth, but only on the jaw, I would obtain a physiologic expansion, which in great measure would make it improbable that there would be cause for a return to the old position.

I therefore have never since made a retention appliance for these cases, but at first, after finishing the regulation, I have kept the patient under observation once a week for a while, thereafter once a month, to see if the appliance last worn would still fit. Experience taught me, that indeed retention was entirely unnecessary, with the exception of some cases, where regulation was done at an older age, and then especially in Angle's Class II cases.

METHOD OF TREATMENT

My method of treatment is as follows: For cases of expansion I apply a vulcanite plate, to which a screw has been attached, which plate has been cut in halves through the center. Every week I see the patient and turn the screw once. This is generally just sufficient if the plate is worn every night. Thus, one has control over the real usage of the plate, and in this way we overcome the only disadvantage of the use of removable plates by children.

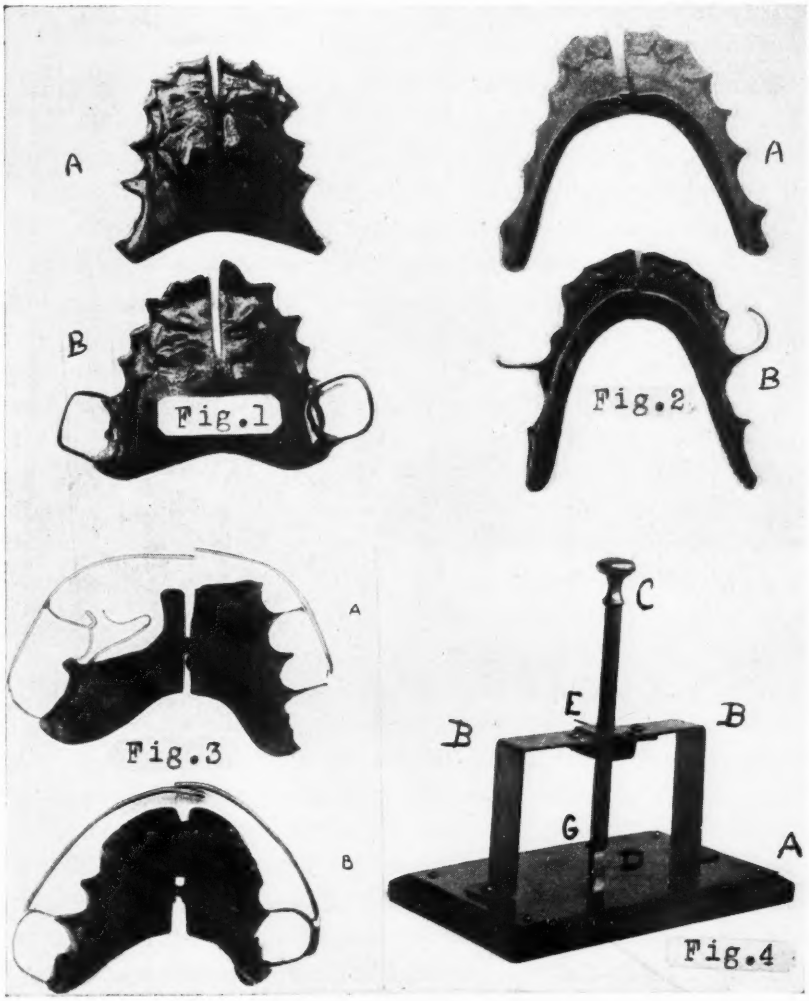
If patients reside out of town, or if they go away for some time to foreign countries, then, if necessary, should the plate become loose, they can turn it themselves. The number of weeks passed must correspond with the number of turns, so that we can always have control over the rate of movement.

Then I attach everything else necessary for the treatment of the case to this maxillary or mandibular expansion plate, e.g., gold springs, which press

the teeth inward or outward; clasps which open the bite; springs which cause the teeth to rotate, etc.

If we desire to exert a one-sided expansion or pressure on one or two definite points, we file so much off the vulcanite in that place, until our purpose has been attained. From the nature of the thing, the cost amounts to little; the gold used is returned, rubber and screw are cheap enough; so judging from this standpoint, the problem gives us nothing but advantages.

Broken springs, loosened bands, etc., do not occur, so the necessary time for treatment is very short, and unpleasant surprises are excluded.



A very important point, however, is the making of accurate plates. In the last years I have had these plates made in my laboratory for colleagues many times. When asking about results, everything was satisfactory; but when later on, a new plate had to be made by themselves, I often heard tales of difficulties, pain on or after turning, inability to put in, badly fitting and therefore dropping of the plate, etc.

The cause of this is, without exception, faulty construction of the plate, which is easily understood when one remembers that these disagreeable things

must occur when the screw has not been vulcanized absolutely at right angles to the plate. To prevent such difficulties, I have made a simple appliance by which any technician can overcome these difficulties, and one can be assured of success.

Fig. 1 *A* is a picture of the most simple form of maxillary expansion plate.

Fig. 1 *B* shows a similar expansion plate with two gold bands vulcanized to the molar teeth. If one so desires, these bands can, of course, also be placed over the premolars. When we wish to open the bite, we place the gold band in such a way that the mandibular teeth strike on the bands, thus causing free expansion of the maxillary molars. When this is not necessary, we can bend the bands in such a way that the normal bite remains intact, or a plate as in Fig. 1 *A* may be used.

Fig. 2 shows the same picture for the mandible. At *B* a different shape of band has been employed, which one must determine of course for each case. The simple form, *A*, I hardly ever use in the mandible, because of the great danger of the plate sagging down and causing pain. This does not happen with the maxilla; however, most of the time I make a band connection, because otherwise in well-fitting plates it would be troublesome to remove the plate.

Fig. 3 *A* shows a plate in which we have a gold spring soldered to the band on the molars and also a wire vulcanized to the plate, pressing the canine outward.

Fig. 3 *B* is an expansion plate with a spring, at the same time pressing the maxillary teeth inward.

Of course, numerous varieties are possible, also the simultaneous employment of swelling-wood has been made use of many times, while in Angle's Class II cases an inclined plane gives excellent service.

It is plain that these plates must be made very accurately to function properly; this is the only factor likely to cause trouble to the beginner.

First of all the screw must be placed absolutely correctly in relation to the median line, vertically as well as horizontally. If this is not done, the plate will be rotated and cannot be used. In order to determine this with certainty I had made the little appliance shown in Fig. 4.

To the plate, *A*, the bow, *B*, is attached in which we find the staff, *C*, with a groove at the lower end, *D*, in which the screw fits precisely and with a tapering end, so as not to prevent the push of the screw backward in the mandible, thus causing the plate to become too thick. The little pin, *G*, serves to prevent the staff, *C*, from being pulled entirely out of the Bow, *B*, when it is drawn upward. The indicator, *E*, is attached exactly at right angles to *B* and *D*, while the staff, *C*, has six sides to it, so that rotation is eliminated.

In Fig. 5 the screw has been fixed on the model. The median line has been scraped with a sharp instrument and gone over with a pencil for the sake of convenience. This incision on the model will show on the rubber plate underneath exactly in the middle, making it easy to saw the plate in halves on this line, by which an easily made fundamental mistake can be avoided.

The screw, *F*, is also of great importance. After long research work I had this made out of nickel. The pitch of the screw thread must not be too

great, otherwise, in turning, there would be too much expansion; furthermore, the screw must fit tightly, not only to be able to turn with difficulty, but also to prevent rubber being pressed between the threads of the screw.

For the attachment in the rubber, the screw-thread is bent a little on one side, while on the other side a small part of the screw-thread is soldered to fit the tube. (Fig. 5 *F*.)

When the impression has not been cut down in the Frankfort horizontal plane, the possibility exists that the plate will be vulcanized crooked in the flask. A simple way to prevent this is to rub the model on the occlusal plane over a coarse plank until it is perfectly flat (see masticating surface, Fig. 5 *H*).

Now we draw with a ruler a pencil mark at the same height around the model and then saw through the model at this line. In so doing we obtain the base parallel to the (rubbed off) masticating surface. Then we place the model in the flask and determine the place of the screw. We can then easily determine either by sight or by means of the indicator, *G*, the median line in the continuous surface.

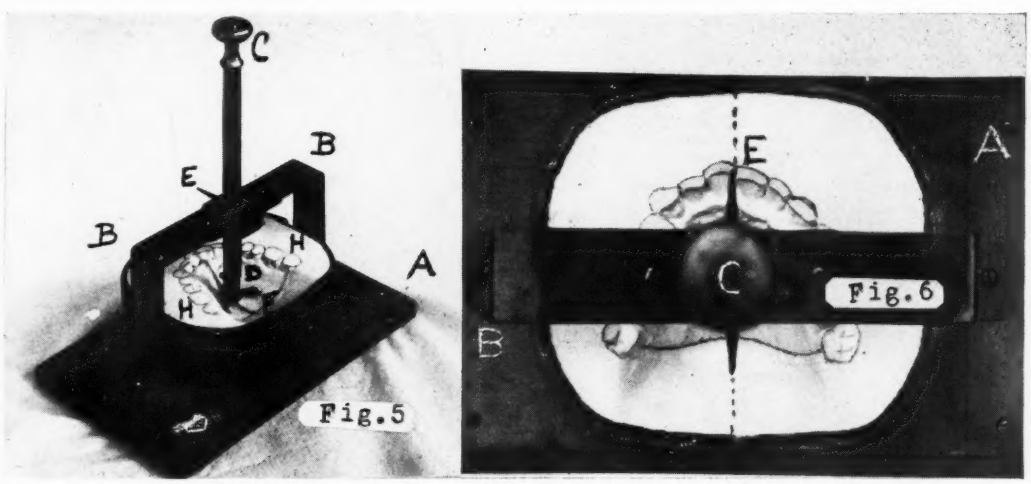


Fig. 6 is the same picture as Fig. 5, only seen from the top, showing that the median line is actually in continuation of *C*, and that the screw is thus being fixed correctly. The place of the screw in the plate is of little importance; it usually is placed in the center. This varies according to the height of the palate.

Now we remove the flask and insert the rubber and press this (without the screw). Again we place the flask in the appliance and now adjust the screw in its place by means of the staff, *C*, i.e., pressed in the rubber. We then draw the rubber carefully over the screw with a pair of pliers. In this way we prevent the shifting of the screw in pressing, while to be on the safe side we cut a groove in the plaster in the direction of the screw to remove the surplus rubber.

Since we have used this little appliance, not a single failure of a plate has taken place.

For the bands I use 18 carat, 2 per cent platinum wire 1 mm. round, and for the springs 18 carat, 5 per cent platinum, 1.6 mm. half-round wire.

The figures which I shall show are some models of treated cases and of cases still under treatment, to give you an idea of what this appliance can do.

Fig. 7 is Angle's Class I. Treatment began April, 1927, when the girl was nine years old; the second model was taken January, 1929.

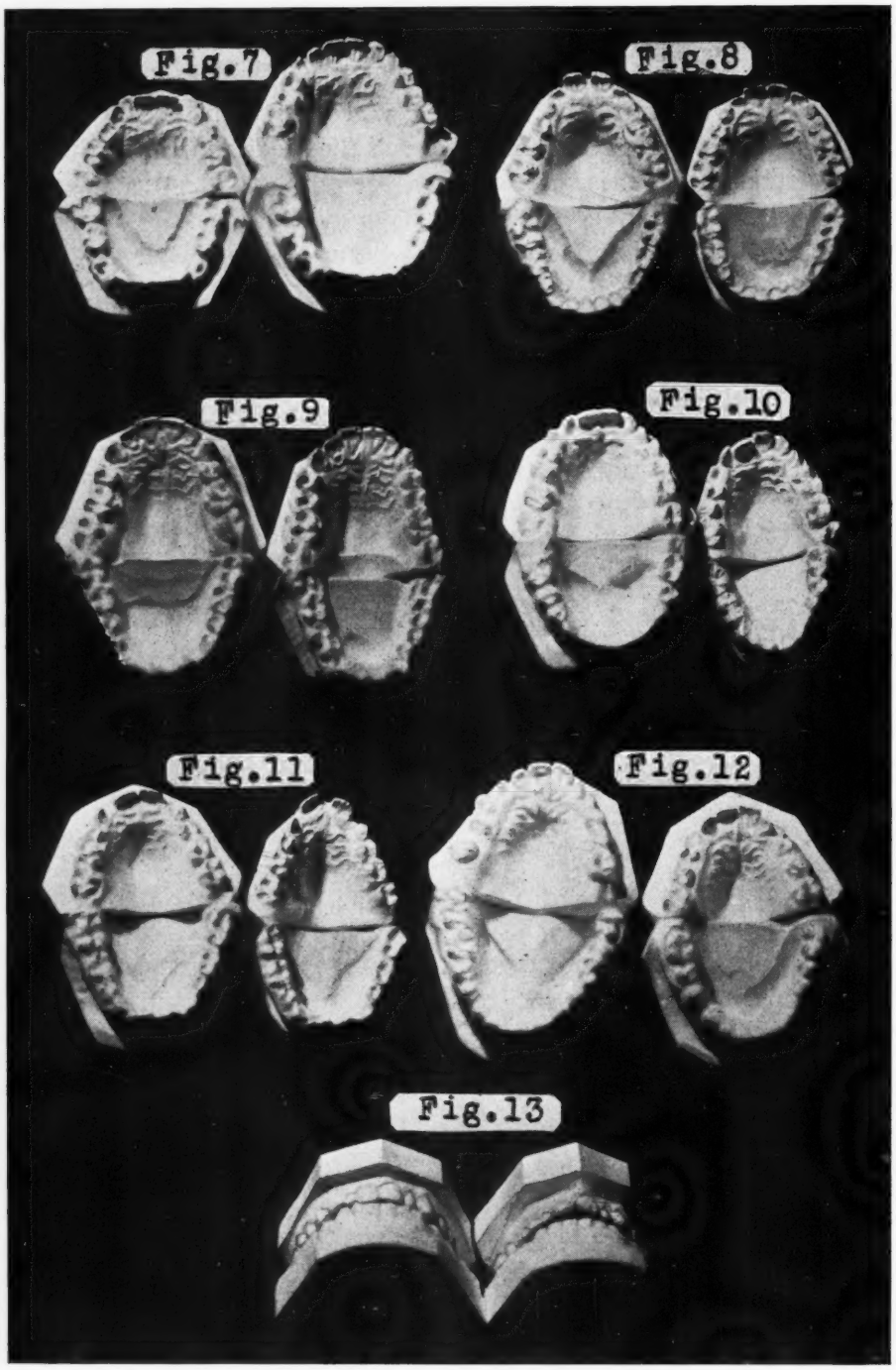


Fig. 8 is Angle's Class II. Treatment was begun October, 1927, when the girl was nine years old. After two months she went to a school in another town, and in 1928 I saw her only in January, April, August and October. The

other models are of January, 1929. As you will see, when looking at the models I have here, the left side is already Class I and the right side is much improved.

Fig. 9 is Angle's Class II; boy of thirteen years. Treatment was begun September, 1926. I extracted the first premolars in the maxilla. The second impression is of October, 1927, to show the expansion of the mandibular arch.

Fig. 10 is Angle's Class II. Treatment was begun October, 1928. Girl of twelve years. Second impression was taken two weeks ago, to show expansion of mandibular arch in seven months.

Fig. 11 is Angle's Class II. Treatment was begun December, 1929. Boy of seven years. The second impression was taken ten days ago. When you look at the models, you may note the improvement of the occlusion in five months.

Fig. 12 is Angle's Class III. Treatment was begun July, 1928. Girl of thirteen years. I brought back the mandibular teeth with elastic and expanded the maxillary arch. Second impression was made in April, 1929.

Fig. 13 is a case of open bite. Beginning of treatment, October, 1925. Girl of eleven years. Last impression of March, 1927.

Summarizing, the principal advantages of these regulation plates are:

1. That they need to be worn only at night, so that they do not in the least interfere with the happiness of the child during the treatment.
2. That they cannot cause any damage at all to the teeth.
3. That they can be used at any age without objection, so that we can start at a very early age without any trouble during the time of the eruption of the permanent teeth.
4. We do not use force by springs, such being uncontrollable, therefore need not fear unexpected effects and resorption.
5. By using physiologic expansion, retention is unnecessary.
6. Through the small costs for material and the little time necessary for treatment, a considerably larger number of children can be treated.
7. This very simple method of treatment can easily be applied by any practitioner.

In conclusion I wish to say that I fully understand you will not go home from here to cast aside your methods of treatment and use this one. But I should be very much pleased if you would in one case or another, when you think it suitable, just try this way of expansion, and I am convinced that then you will do it again and thus become a supporter of this method, greatly to the benefit of our little patients, who have long been waiting for a method of treatment whereby they can all be helped in the same manner as is now the case in operative dentistry.

A REPORT ON SOME TYPICAL CASES OF MALOCCLUSION WITH METHODS OF TREATMENT*

By H. C. Visick, L.D.S., England

ALTHOUGH I have nothing new or original to present, I thought it might initiate a helpful discussion if I showed you slides of some of my cases before and after treatment, and described the methods used.

When I started to treat orthodontic cases many years ago, we used vulcanite plates almost entirely. Then came a period when we used all-metal Jackson Crib Plates.

After being at Dr. Angle's school in 1906, I used Dr. Angle's appliances for some years, more particularly for the intermaxillary traction in Class II cases. Orthodontics in those days was a very trying job, as the German silver bands were continually breaking, the tubes getting bent and the ligatures coming off the teeth. This, coupled with the discoloration of the metal and inflammation of the gums, was very depressing, and I practically gave up attempting to correct Class II cases without extraction. For the next twelve years, I confined myself largely to the use of removable appliances, consisting of vulcanite plates held in by gold cribs, with gold spring wires to move the teeth. I still used fixed appliances principally for retention and for rotating teeth.

For the last five years, I have been largely using the lingual arch and precious metal appliances under what is known as the Mershon technic, and my experience is that it easily surpasses the older methods. Strength, reliability and cleanliness are great points in its favor. The materials are so tough and strong that the bands never break, and as there are no ligatures, that constant source of trouble is eliminated. In this system the teeth are not subjected to violent or jerky pressures. The essence of the treatment is slow and sure movement. My experience with these appliances has been so satisfactory that the last few years I have been tempted to again undertake the treatment of Class II cases without extraction. Time will prove whether these cases will remain corrected, but there are grounds for hoping that the results will be permanent. The earlier we can correct an irregularity, the greater the chance of permanence, and these delightfully neat appliances can be put into the mouths of quite young patients.

Another point is that we can continue the treatment for a much longer time, the appliances being so small and clean, and giving so little trouble to the patient and the dentist.

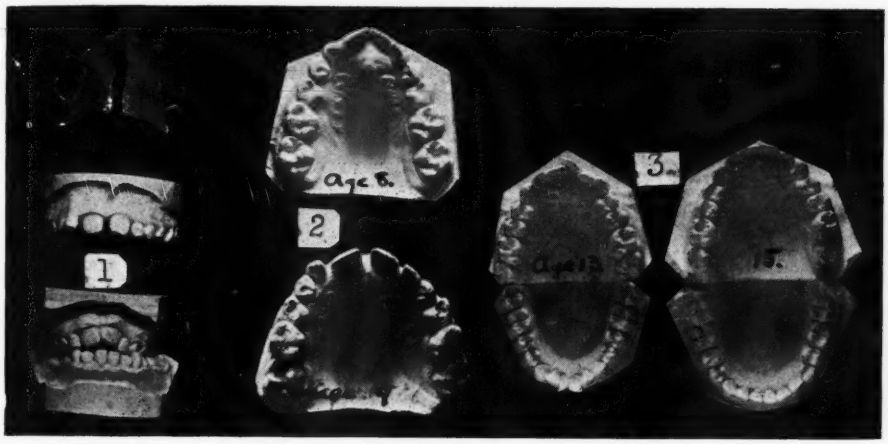
With Class II cases in the old days, we used to divide our treatment into active treatment and retention, and I expect some of you can remember the great difficulty we had with inclined planes fixed to molar bands which used

*Transactions of British Society for the Study of Orthodontics.

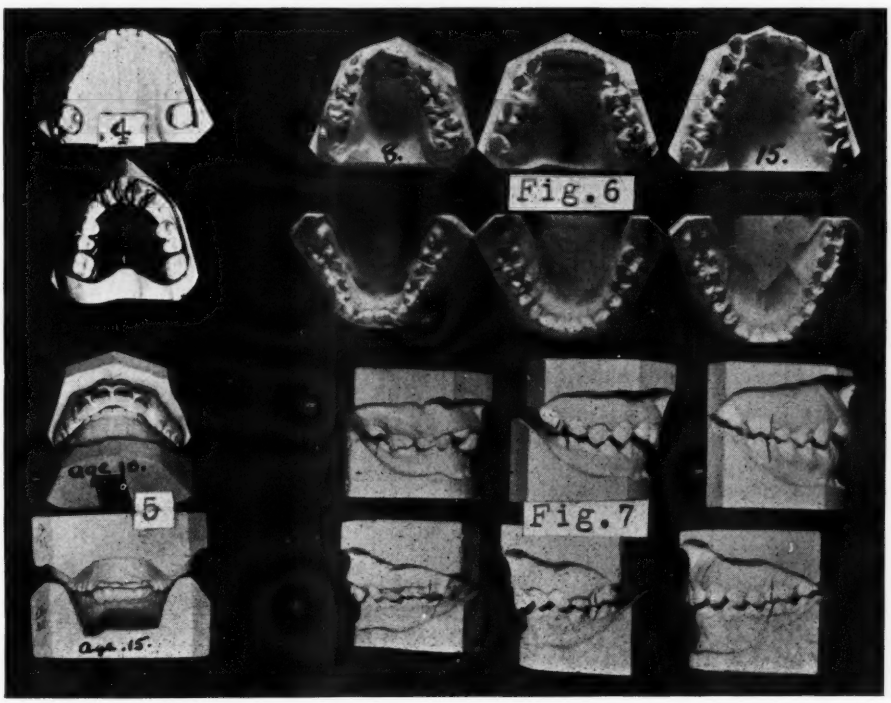
to break every few weeks. Nowadays, the tendency is to combine active treatment and retention in the one appliance.

CLASS I

CASE 1 (Figs. 1 and 2) was a boy aged nine years, with a very narrow maxillary arch which was associated with a completely blocked nose. I put



in two Badcock expansion plates in succession, and in nine months the arch had expanded as shown on the second model. In this case I separated the two halves of the maxilla; on applying pressure to the outside of the maxil-



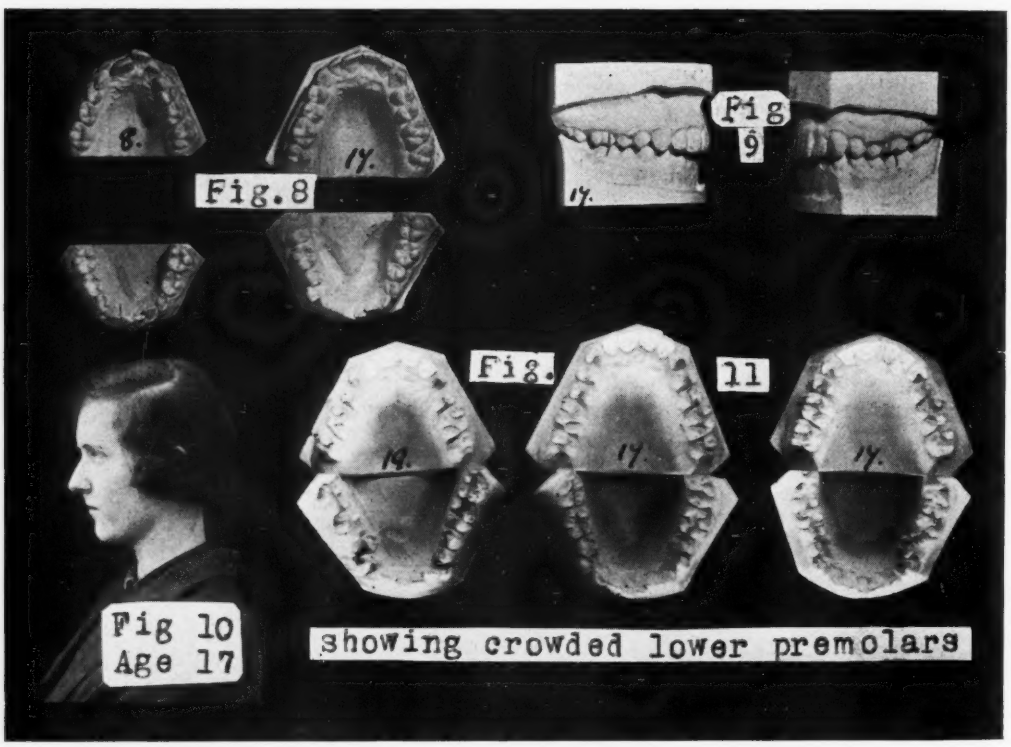
lary molars, one could see the centrals moving. I still use Badcock expansion plates in all cases needing expansion. I think they are the most simple means of obtaining a definite expansion all over the arch. Having obtained the

necessary width with one of these plates, I then put on a lingual arch which is an excellent retainer.

CASE 2 (Fig. 3). This is the type of case which was treated much too late. The arch was considerably enlarged all round, and the teeth are in fair position. But I feel sure we should be disappointed with the final result in, say, ten years' time.

TREATMENT OF CLASS II CASES (FIGS. 4, 5, 6, 7)

I know some people that if we expand the maxilla, the mandible will sometimes jump forward into normal occlusion. All I can say is that I have never seen the slightest tendency for a Class II case to correct itself. My



experience is all the other way, and I sometimes wonder if I have ever obtained a perfect and permanent result in a Class II case when I have attempted to bring the mandible forward.

If there is an excessive overbite, I generally put in a vulcanite bite-plate with spurs on the incisor teeth. This is worn for six months or a year. At the end of that time, it will be found that the overbite has largely disappeared, and then one can go ahead with fixed appliances and intermaxillary traction. In cases where we have had to extract the first maxillary premolars, the canines and incisors should be slowly retracted during the period when we are correcting the overbite.

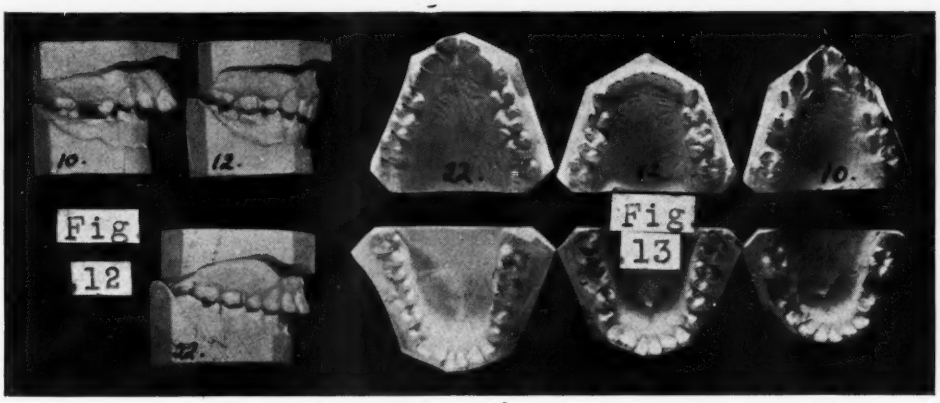
If the patient is older than about ten years of age, I should prefer to do the retraction of the maxillary teeth with a fixed appliance so as to prevent the back teeth tipping forward. This is most important. It is a very easy matter

to ruin the bite entirely by attempting to pull back stubborn teeth. It is not only age which determines whether we should use a fixed appliance or not. Cases vary enormously in their resistance to tooth movement, and as far as I know there is no means of determining beforehand which case is going to prove difficult, and which easy.

Cases 3 and 4 (Figs. 8, 9, 10, 11) are Class II cases, treated some years ago (without extraction) by general expansion, and then intermaxillary traction. The results are far from ideal, and I quite expect that in another ten years, when the third molars have erupted, the condition will be much more disappointing. I want you to notice how often the mandibular premolars become wedged together and crowded out of the arch. This usually begins to show itself at about seventeen years of age, although I have frequently watched it getting worse and worse up till the age of twenty-five years.

Mr. Visick interrupted the reading of his paper to remark that on one occasion in his earlier career, he received a letter from a dentist asking him if he would extract for him from a child the four first premolars. He was very indignant at such a request, and sent a note back, which he hoped was polite, saying that his conscience would not allow him to extract four premolars in a boy. The work was done by some one else, and not long ago he saw the patient, now a grown man, and the result was quite a passable one, as far as the teeth were concerned, though the appearance of the jaws was rather puny for so big a man. Today, if anyone asked him to take out the four premolars, he thought he would still make the same reply; nevertheless, he had seen so many dreadful cases of impacted mandibular third molars that he might possibly, in time to come, shift his ground.

Cases 5, 6, 7, 8, and 9 are Class II cases treated by extraction. The first one (Figs. 12 and 13) I used to be very proud of, and for many years used it to demonstrate to skeptical parents what I could do. When I was asked to



read this paper, I thought I would make an effort to get in touch with this patient, who had left school ten years before. His dentist took impressions for me. The result was a great shock, as you can imagine! The fault in this case was, I think, that treatment was started much too late, and retention was too short.

After-treatment photographs of the patients' profiles in Cases 7, 8 and 9 are interesting in view of the fact that I have extracted the first maxillary premolars.


Fig 14a
Fig 14b
Fig.15a
Fig.15b
16a
16b
16c
17a
Fig.17b

CASE 10 (Fig. 18). This is a case treated without extraction, and with the modern appliances, when patient was nine years of age, and I see not the slightest sign of the teeth returning to the old positions, although the elastics have not been worn for ten months.

CLASS III

Class III cases are the most hideous when they have developed, and the patient is handicapped for life with an ugly jaw and a most awkward bite, but if tackled early they are easy to treat and there is no relapse.

There is one aspect of Class III cases in which I beleive they differ from every other class, and that is in the way they sometimes progress. They can start with a single maxillary incisor getting behind the mandibular teeth. Or a mandibular deciduous incisor, about to be lost, tips forward and catches on a maxillary incisor, and the patient feels it is more comfortable to bite with the mandibular teeth forward. Once this position is established, the other teeth drop automatically into the wrong position one by one as they erupt.

It is rather like a game of skittles, when you knock over one and that knocks over the next one, and so the downfall extends to the whole lot.

This explanation will not cover all cases of Class III, but from what I have seen I believe it holds good in many cases, so it is easy to see that a very little treatment will correct the first two or three teeth, or in the case of deciduous teeth being wrong, if we watch for the eruption of the permanent teeth and guide the first two into correct positions, the rest will follow.

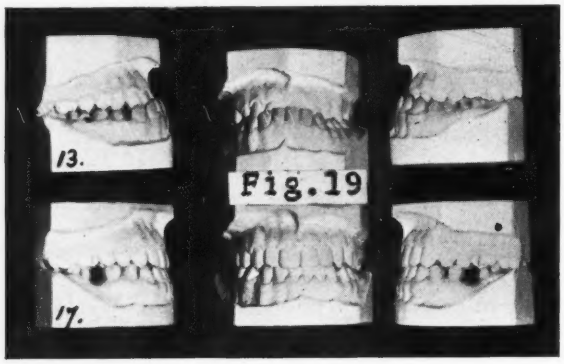
A very satisfactory point about Class III cases is that they are the only ones which are really retained by correct occlusion. We have often been told that to obtain retention, all that is necessary is to establish correct occlusion, and the interlocking of the cusps would do the rest. Alas! Scores of failures have proved this pleasing theory to be unsound. On the contrary it is strange how little influence the inclined planes of one jaw exert on the inclined planes of the other.

Occasionally, in the case of narrow maxillary and mandibular arches, I have managed to expand the mandibular and carry the maxillary with it. But this can be done only in certain deeply interlocked cases if the expansion of the mandibular is very gradual indeed.

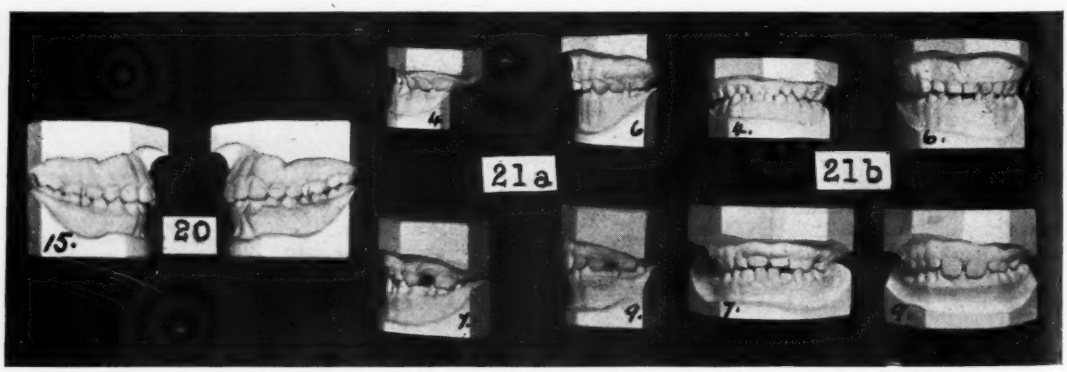
The next three cases are all Class III.

Case 11 (Fig. 19). A girl of thirteen years had two abscessed mandibular first molars which I extracted, and most of the correction was done by pulling back the mandibular front teeth. I saw this patient ten years later, and the teeth were still in the same position, but she told me that she often had to put in the mandibular retaining appliance to prevent the teeth coming forward.

Case 12. This was the youngest patient for whom I have ever attempted treatment. He was eighteen months old when his mother brought him to me with all the mandibular teeth locked well in front of the maxillary teeth; in



fact, when he shut his mouth, the maxillary teeth disappeared from view. I used an Angle's chin-and-head cap with elastics with considerable trepidation, wondering what the effect on his skull might be. I was pleasantly surprised at the rapidity with which the mandible was pushed back, and at the end of six or eight weeks we were able to discontinue the use of this apparatus, and the result twelve years later is shown in the next model. This boy's sister, age seven years, is showing signs of becoming a Class III case in her second dentition, the maxillary centrals have got behind the mandibular laterals.



Case 13. Treatment in this case was started at four and one-half years of age. Her paternal grandmother, seventy years of age, is also a Class III case. I have no doubt myself, that this child has inherited the condition. What mysterious force is it that can so persistently, after such a long period, produce this irregularity?

I began by pushing out the deciduous maxillary incisors and canines with spring wires on a vulcanite plate. When the permanent maxillary incisors erupted, they also showed an inclination to erupt behind the mandibular in-

cisors, and I then used a fixed appliance with finger-springs to press the teeth forward. At the present time all is going well.

To sum up my observations on these cases:

Class I cases with crowded incisors call for very lengthy retention; three or four years will not be too long, and even then, they will always show signs of relapse, especially if treated without extraction.

Class II. (A).—Treated by expansion and intermaxillary traction. Relapses certain unless treated early, not later than nine years of age.

(B).—Treated by extraction of maxillary first premolars. Pleasing result certain, and no relapse if treated early. Crowding of mandibular teeth very frequently occurs when third molars erupt.

Class III. No relapse, if treated early.

As this is an anniversary year of the foundation of our Society, I am tempted to make some general remarks reviewing the results of my study of orthodontics.

When I was being initiated into orthodontics at Guy's Hospital thirty years ago, much was made of etiology, and we were told that it was absolutely necessary, before we treated a case, to find out the cause of the irregularity. I must confess to you that today, in the majority of cases, I make no pretense of discovering the cause.

It may be an admission of indolence, but I am tempted to ascribe many irregularities to heredity. With what pertinacity some teeth insist on erupting badly! Incisors and premolars persist in rotating as though under some malign influence; teeth do not fully erupt; maxillary molars erupt lingually; Class III cases appear generation after generation. Inheritance seems the only explanation.

TREATMENT

In Eastbourne there are many schools where children come from all over the country, and indeed much farther afield.

This is helpful, as we see every variety of orthodontic appliance—some beautiful, others fearful and wonderful!

Plates with inclined planes to "jump the bite" are a failure in every case I have seen. Perhaps I have been unfortunate.

Orthodontic plates made completely of vulcanite which cover the back teeth, are a source of rampant caries. I remember one case where a molar and premolar on one side had completely crumbled away, nothing was left but the roots, which had to be extracted. Such plates are quite unjustifiable, but we still see quite a number of them.

The use of wooden pegs is happily dying out, but we still get a few to annoy us. A piece of gold wire used instead can be adjusted in a moment and is much simpler.

Orthodontic cases ought to be seen at frequent and regular intervals. In the case of boys, I think a weekly visit is not too often. Although we may not have to do anything to the appliance, it is essential that the patient should be kept up to the mark in cleanliness, and again, if something goes wrong with the appliance, it is at once put right. Girls are much more reliable in the

carrying out of instructions than boys. My practice has been to find out which is the most convenient hour and day for the school to send the child down, and then to book that time ahead every week throughout the term. This has worked very satisfactorily, as forgotten or mistaken appointments are rare.

My paper is largely a confession of ignorance and failure, but of all the branches of dentistry, I still find the study of orthodontics the most difficult, the most tantalizing, and the most fascinating.

DISCUSSION

The President, *Mr. G. Northcroft,* said that the audience had listened to a very interesting exposition of Mr. Visick's triumphs and failures. It was extremely good to have a man so courageous that he would place on the screen cases which might be described as a little unfortunate in the way they had turned out. All those present, however, were well acquainted with failures in orthodontics. Among the mass of material which the author had brought forward there were one or two things on which he himself would like to make a comment. On one point he desired to warn Mr. Visick: he noticed that in one of his Class II cases, the intermaxillary hooks on the mandibular sixes were put on the distal corners of the sixes, which in his own hands had proved to be a dangerous practice. He now placed the hooks on the medial corners of the sixes invariably. In this way one did not get that undue pressure from a lingual arch on mandibular incisors, and the result was more satisfactory.

Mr. Visick had spoken against the results of forward vulcanite biting plates, and said he had never seen a success. The speaker had had three cases which he knew had been absolute successes, one which he finished in a girl of twelve; she was now eighteen, and her bite was perfect. He did not say this because she happened to be his patient, but because a perfect result did happen occasionally.

Mr. Visick had raised the point that orthodontic treatment produced impacted mandibular third molars. The speaker thought this was an absolute mistake. The impacted mandibular third molar was developmental and had nothing whatever to do with orthodontics. It might be brought to the dentist's notice more because perhaps orthodontists x-rayed their cases more than other people. But all these things, he was sure, were developmental in origin. In the same way a rotated incisor was due to the fact that it was rotated in its crypt to start with.

He was interested to hear that Mr. Visick had come to the conclusion that a vast number of these cases were due to inheritance in some form. But one had to be careful, as he had said on a previous occasion, not to confuse cross-breeding or the mixing of racial characteristics with the inheritance from father to son of a peculiarity. It did not explain the thing to call an irregularity inherited simply because a grandfather happened to have had it. He was quite convinced that many of these irregularities were inherited and that many of them arose from cross-breeding.

Mr. Maxwell Stephens, after congratulating the author on a very interesting paper, said that Mr. Visick in attending so many school boys, was fortunate in having seen the work of a number of men scattered over a wide area, and he had taken what might be described as a wide-angled view of orthodontic work. The speaker thought that the esthetic sense was sometimes a great trial to the possessor. With regard to the first maxillary premolars, their early extraction often made a very noticeable difference to the face: in the case of a big man such as Mr. Visick described, the result was to give a smallness to the face which did not accord with his general stature. Then there was a point with regard to the expansion plates. Mr. Warwick James always cut out the vulcanite at the back of the screw, and the parallel bar, as it enabled the cleansing of the plate to be carried out more easily, and he (the speaker) found on following this procedure that it did not interfere with the holding up of the plate at all, and it made a very sound appliance of it. With regard to the Badcock plate, it should be cut down to the cervical margin and not left on the inclined planes of the lingual surfaces of the teeth, otherwise there would be displacement as the plate was

opened. In a good many cases appliances had been used without any extractions whatever being performed. We had a good many records of cases started at the moderate age of eight, nine and ten years, when histories could be substantiated, but as yet we had still to wait for records.

Finally, in considering the treatment of Class III cases which the author maintained were easy to treat: there was a type he had met with which was by no means easy, and might be impossible to treat by the usual methods. He therefore claimed that certain types must be differentiated and their etiology accounted before satisfactory treatment could be pursued.

Mr. H. G. Watkin said they would all agree with the author that permanency of results was the desired object. One point not sufficiently borne in mind was the size of the tongue. In a number of the cases which the author had shown one of the premolars had moved lingually. If the tongue were sufficiently big probably the teeth would remain as they were placed, but these abnormalities occurred where there was more pressure outside from the teeth than inside from the tongue, and, therefore, the jaw did not remain extended. When he saw the overbite so reduced by angles or arches, he thought some of that overbite reduction was probably brought about by the elongation of the molars. The author had stated that the Class III cases were handicapped for life. The present speaker did not agree with that; he thought there was a way out, and at the next meeting of the Society he was hoping to read a paper on that subject.

Mrs. Robert Lindsay, speaking with regard to the Class III cases, wondered whether Mr. Visick had seen the x-ray photographs of the deciduous dentition by Drs. Bustin and Leist in Germany. These investigators were engaged in a series of studies, and curiously enough the cases they met with nearly all belonged to Class III. They divided the cases into "symptomatic" and "genuine," and showed in their pictures that where there was a gap between the latest erupted tooth and the germ of the developing tooth in the jaw there was a favorable prognosis, and those cases could be treated, because of the possibility of utilizing this space; but where there was no space between the latest erupted tooth and the tooth germ in the jaw there was the prospect of trouble for the orthodontist. These workers suggested that all these cases as well as the cases in Class II, should have x-ray photographs taken systematically. The pictures they produced were very interesting and worthy of the study of all orthodontists. They showed movements of the tooth germs in the jaw actually underneath the deciduous teeth. Mr. Visick had said that some of his cases were heartbreaking; she had wondered whether x-ray photographs were taken in these cases to see whether this space between the tooth and the developing germ existed in these cases, thus giving a more certain indication of the results of treatment.

Mr. Robert Lindsay said that he did not desire to intervene in matters involving treatment, but like all the members he was interested in what Mr. Visick had shown. One point arose on the first slide; this was a case in which there was separation of the maxillary suture. He noticed in the last of the models that there was a distinct space between the two front teeth. This presumably was due to the fact that there had been a deposit of bone in the suture, and raised an interesting question if Mr. Visick proceeded to close these two teeth together. Either the two teeth would be approximated by moving them through the bone, or the pressure would result in the absorption of the bone in the suture and possibly the reproduction of the narrow maxilla with which he started. It would be interesting to learn what actually happened after treatment.

He noticed with some astonishment that nothing had been said about systematic x-ray photographs being taken in these cases. He would suggest that the x-ray evidence should be obtained in every case, not merely in those particular matters to which Mrs. Lindsay had just drawn attention, but that wherever possible x-rays of the temporomandibular joint should be taken, as they might explain a good deal with regard to cases in both Class II and Class III. In the early stages the temporomandibular articulation was a very loose affair, and judicious manipulation apart from movement of the teeth might improve the case materially.

With regard to the lapsing of cases, he noticed that all the pictures shown were of the buccal aspect of the articulation; in no instance was the lingual aspect shown. With a perfect appearance of normal occlusion on the buccal side, there might be a different condition of the lingual cusps, and this had been held to account for lapsing. In certain cases of English people the lapse might be due to a reversion to type. Continental caricaturists were always calling attention to the fact that there was a pointed variety of mouth among English people, and those cases which Mr. Visick had treated and which had reverted again might be simply reversion to the type to which that particular person belonged.

Mr. H. Chapman said that he had found the author's retrospect of the situation during the last twenty years most delightful. On one point Mr. Visick had asked for advice. It was easy to give advice when one had not to carry out the treatment, but if the case were his own he would certainly take out four teeth, in the mandible two premolars, and in the maxilla, on the left side, he would probably remove the lateral because it was rotated, and on the right side he would probably take out a premolar. The Society would remember that some time ago he himself showed a case in which he removed a lateral in a somewhat similar position, and instead of the canine coming into the place of the lateral, the first premolar moved so far forward that the canine could not get in. Therefore he would suggest that something should be put in to keep the space until the canine erupted.

He was not quite sure whether Mr. Visick had made up his mind that the removal of two premolars in his last two cases was preferable to keeping all the teeth. He seemed to have got some excellent results by the removal of premolars. Had he arrived at a definite decision on that point? The speaker himself had not succeeded in treating cases such as Mr. Visick had shown without intermaxillary retraction. It might be that he was referring to a different type of case, but he had arrived at the opinion that to get a successful result in Class II cases constant intermaxillary traction was essential. He mentioned this because some patients seemed to be negligent in keeping their rubber bands on all the time. If there was a wobbling of the mandible backward and forward, he was inclined to think that impaired the prognosis. He was surprised to hear Mr. Visick say that he used a Badcock plate to get the lateral expansion, and then afterward put in a lingual arch. It seemed to him that he might just as well have put in the lingual arch at the beginning.

He had been interested especially in the Class III cases in which the chin-strap and headpiece had been used. He had heard of that being done, but had never seen a case. One question which he would like to ask Mr. Visick was whether he still removed the mandibular incisor in certain of these cases. It seemed to be the general experience that a mandibular incisor very often did not effect any improvement.

Mr. Cutler had been interested in the description of Class III cases and noticed the author's stress on the hereditary factors. It was often said that enlarged tonsils might be a local factor, and the speaker had seen three cases in children which bore this out. The last of the three was a child of seven, whose mandibular teeth were biting right outside the maxillary teeth. His parents had a normal Class I articulation. He asked them whether there was any history of tonsillar trouble and was told that the child was then under treatment for enlarged tonsils, but that the removal of them had been deferred on account of the child's bronchial condition. Would the author consider the removal of the first premolars and retraction of the six mandibular front teeth to be good procedure in a patient about twelve years old?

Mr. H. C. Highton said that he was beginning to wonder whether it would be advisable to extract the mandibular incisor in a perfectly normal Class II case. In one such case he had had practically a perfect result seven years after the operation. The bite was perfect.

The *President*, in closing the discussion, pointed out to Mr. Lindsay that radiographs of the mandibular joint were extremely difficult to obtain and very unsatisfactory when obtained, being practically impossible to read. He doubted whether it would be very much good to attempt such a thing as Mr. Lindsay had suggested. He himself had often endeavored to get it done, but he had never obtained any satisfactory results. In 1914, at the International Dental Congress he showed a case where he thought he had separated the two

maxillae, but he was severely criticized by one authority there who said that this was impossible, and showed slides to illustrate the impossibility.

Mr. Lindsay had raised another point upon which Dr. Friel also laid great stress, namely, the number of cases of Class II in which there was rotation of the molars. It was the occlusion of the anterior lingual cusp of the molar which was far more important than the occlusion of the buccal cusps. When members had got very nice results from the buccal aspect they should pay some regard to the lingual aspect also. He appreciated Mr. Highton's reference to the incisors. A case sent to him had been treated with intermaxillary traction and showed exactly the same thing as Mr. Highton had mentioned.

Mr. Visick, in replying on the discussion, took up the President's point with regard to bite plates. All he could say was that he, personally, had not seen a Class II case successfully treated by bite plates, and he did not think it would be a very good way of treating these cases. He would use intermaxillary traction and have done with it.

As to the impacted third molars, he had not really meant to say that orthodontic treatment *caused* the impaction, but if a tooth were extracted the impaction was not so likely to occur, or if it occurred it would not be so grave. He was of opinion that if, by keeping all the teeth, the orthodontist thought there might be impacted wisdom teeth he ought to extract something. He had seen patients suffering much from impacted wisdom teeth.

In reply to Mr. Maxwell Stephens, he did not pretend to have shown anything new. He had simply been in a position to see a large number of cases, and if anything new came along which appeared likely to be useful he had made a note of it. With regard to expansion plates with the vulcanite cut away from the screw, he had always looked upon them as workman-like, but he had not followed the practice himself.

As to the suggestion that Class III cases should be divided into different sections he quite agreed. Class III cases, as a rule, had something wrong with the mandible. In the case of Class II, it was partly the maxilla and partly the mandible, but in Class III it had often simply to do with the mandible slipping forward. Once this process had started it was going to become progressively worse.

Mr. Watkin had mentioned the size of the tongue. The difficulty he had found was to decide whether the tongue was large or small. He had made patients put out their tongues, and some of them had very large tongues with a narrow arch. He could see that there ought to be a big influence exerted by the tongue upon the teeth.

As to the overbite corrected by the eruption of the molars, he did not pretend to say how the overbite was corrected. It seemed probable that it was a combination of several things, the molars themselves erupting, the mandibular incisors being pressed into their sockets, and general growth all round.

He had not read the studies of the German dentists to which Mrs. Lindsay had referred. He was sure that they were very interesting. He was of opinion that Class III cases often started by a slight discomfort in the front of the mouth. A mandibular incisor got loose, the child brought the jaw forward to avoid contact with the maxillary teeth, and a Class III case was the result.

Concerning the examination of the mandibular joint with x-rays. He had occasionally by accident got a good result, but when he really wanted a picture of the condyle, he had never got a good one, at least not with his ordinary dental x-ray apparatus.

The interesting question had been raised as to whether it was possible to alter racial type. If a boy came in with protruding incisors he would have a shot at it, any way.

He had been interested to hear Mr. Chapman's advice on the subject of extracting the four premolars. He himself had been wavering on that subject, and wondering what he should do in the future. He had never had the pluck to take out a maxillary lateral except in one case where the unerupted canine had eaten away the root of the lateral. He must say that he would rather shrink from taking out a lateral. He had seen one case in which two centrals were taken out—not by himself—there were records of this in the Proceedings of the Society—it must have been about twenty years ago. The result was quite wonderful, the space was absolutely closed up, the two laterals came together, and the result was quite a pleasing one. A question was asked as to whether the maxillary premolars should be taken

out in a Class II case. He thought the chances of a permanent result were much greater than if the mandible were pulled forward. With regard to the question of retention, he did not use a fixed appliance for retention, but always a removable appliance, to be worn night and day for the first three or six months, and after that for the night only.

The question of treating a Class II case by extraction depended upon the case itself. He thought it was doubtful whether a permanent result would be obtained by intermaxillary traction in cases treated later than ten years of age. Mr. Chapman had asked why he did not use the lingual arch for expansion straight away. He had not had good results by that procedure, but with a Badcock plate he knew what he could do.

Mr. Cutler had spoken about Class III cases and heredity, and had asked whether he would extract the mandibular first premolars in a Class III case in a child of twelve. He thought that was the only possible treatment. A good result would not be forthcoming even then, because the chin itself was too far forward.

Mr. Highton's remarks about the mandibular incisors were very interesting. He had taken out an incisor and had got the teeth all right for the time being, and two or three years later they were crowded again, so that he had taken out another incisor. He had done this very rarely, and he was driven to the opinion that the taking out of an incisor was not of much use. The best thing was to expand, and he was hoping that with the wonderful new appliances now available the procedure would be simplified. He wished to thank the members for the sympathetic reception given to his paper.

The *President* expressed the thanks of the Society to Mr. Visick, and the meeting terminated.

INSTRUMENTS FOR INSERTION AND REMOVAL OF THE LINGUAL OR LABIAL ARCHES WITH HALF-ROUND ROD AND TUBE LOCK*

By Herbert A. Pullen, D.M.D., Buffalo, N. Y.

ONE of the most difficult procedures in operative technic is the insertion of the half-round rod into the half-round tube for either the lingual or labial arch.

Instrumentation in this case must be carefully studied in order to avoid slipping of the arch in the beak of the plier which is used and to see that the plier is planned in length of handle, firm grasp of beak, double curve of the neck of the plier, comfort of position and universal use in maxillary or mandibular arches and right or left side.

I have designed a plier fulfilling these conditions, Fig. 1.

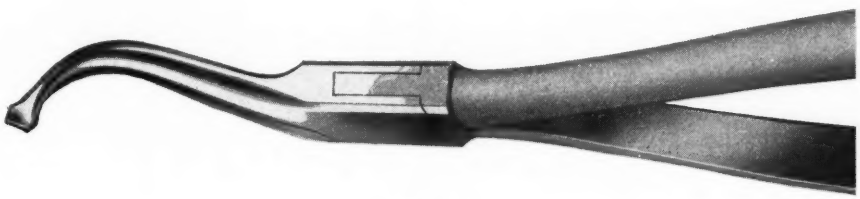


Fig. 1.

This plier is intended for firmly grasping lingual and labial arch wires over the lock and placing the half-round rods securely and easily in position in the locks on the bands of molars or other teeth.

The plier is universal in its application to the maxillary or mandibular, right or left, lingual or labial arch locks.

Fig. 2 illustrates its application to a lingual arch lock, and it will be found that the length of the handle, the extension and double curve of the beaks allow it to reach the rather inaccessible places in the lingual portion of the mandibular arch, et al.

The secret of the power of this plier lies in the detailed construction of the extremities of the beaks, especially of the inner surfaces, as shown in Fig. 3. The internal surface of the beak presents a horizontal groove cut across the inner face a short distance from the lower edge, this groove grasping the arch wire. A vertical groove joining the other at right angles engages the half-round rod.

With the use of this plier the lingual or labial arch locks may be seated with precision and accuracy.

*Clinic presented at the Twenty-ninth Annual Meeting of the American Society of Orthodontists, Nashville, Tenn., April 8-11, 1930.

The unlocking and removal of the half-round rod from the half-round tube in either the lingual or labial arch lock is quite as difficult an operation

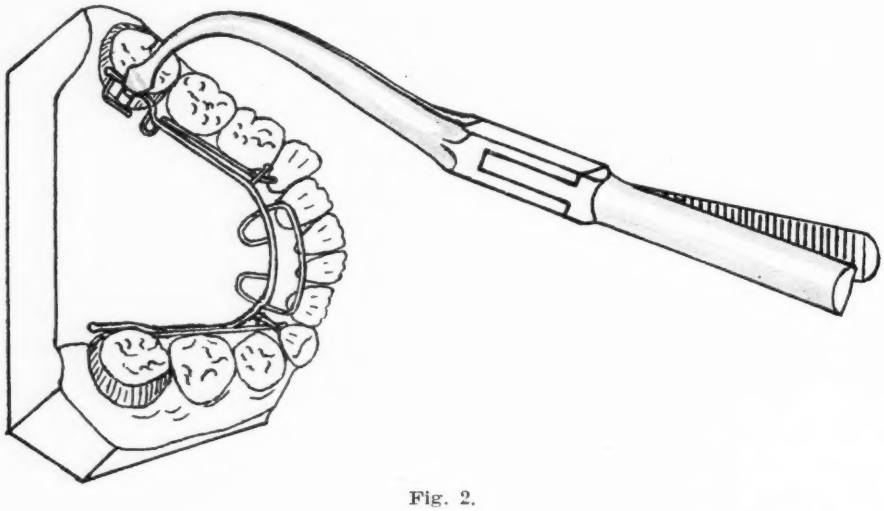


Fig. 2.

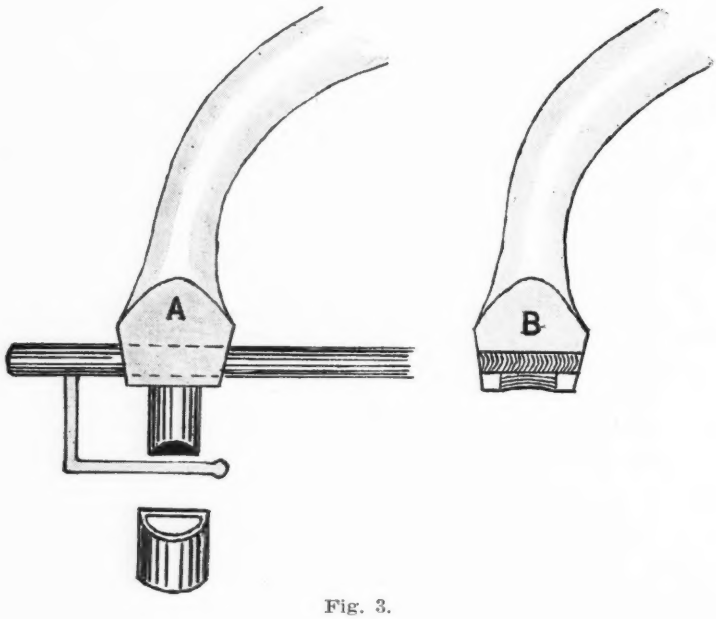


Fig. 3.

Fig. 4.

as the insertion of the arch lock and requires an unlocking and removing instrument of special design to answer the requirements of efficiency, universality of application, and comfort and convenience in use.

Such an instrument, described as a lingual and labial arch removing instrument, is shown in Fig. 4, and its extremity consists of double hooks curved to engage the arch wire and the locking spring.

In use, one hook is first engaged with the spring lock which is removed from its locking position, Fig. 5, and then the hooked end engages the arch

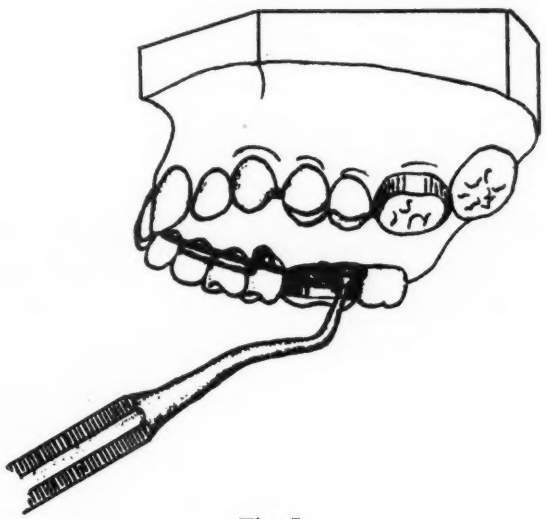


Fig. 5.

wire proper, close to the arch lock; and by a direct downward or upward pull, as the case may be, the half-round rod is removed on the one side, and then on the other, by a repetition of the operation.

This instrument will enable the operator to remove the arch skillfully, painlessly, and with the least number of motions.

A MACHINE FOR SHARPENING MODEL TRIMMER BLADES*

By William R. Humphrey, D.D.S., Denver, Colo.

THE machine described in this clinic is in reality a slide rest upon which a blade for any plaster trimming machine is sharpened. It was made principally for the Wolfsohn Model Trimmer. The machine is so constructed that

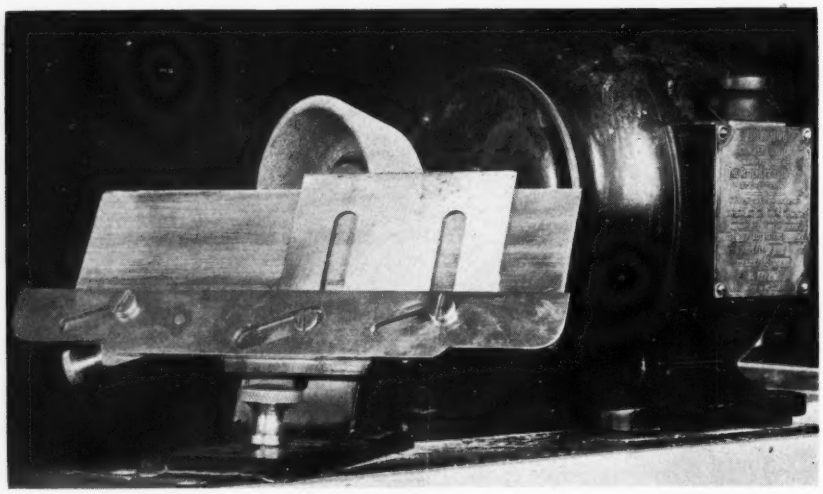


Fig. 1.

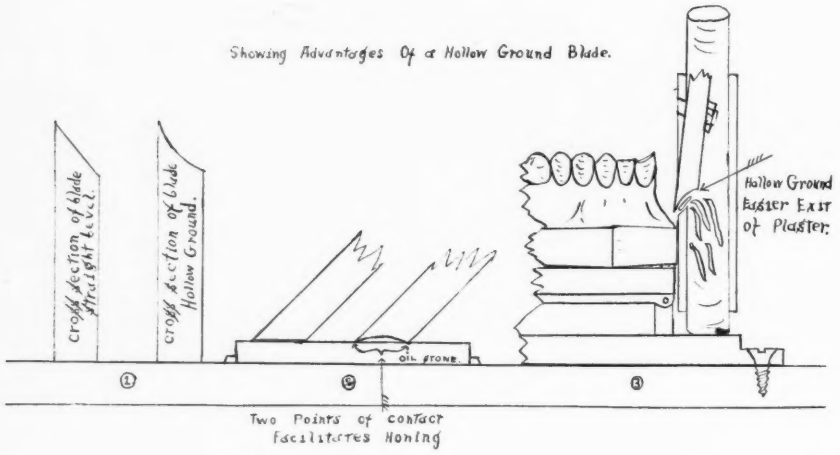


Fig. 2.

it can be used in connection with any dental lathe. In Fig. 1 it is attached to a Ritter dental lathe. A special cup-shaped carborundum stone is furnished on an arbor to fit the Ritter lathe, and the blade is held in position against the

*Clinic presented at the Twenty-ninth Annual Meeting of the American Society of Orthodontists, Nashville, Tenn., April 8-11, 1930.

corner of the cup-shaped carborundum wheel. The blade is moved slowly from side to side. This hollow grinds the blade. There are several advantages to be found in a hollow ground blade, Fig. 2. In the first place, it facilitates honing or sharpening of the blade on the oil stone, as there are only two points in contact. It also gives a larger exit for the plaster when the blade is placed in the machine, No. 3 in Fig. 2. The rest is attached to the workbench by means of a screw and plate. The plate is attached to the under side of the workbench; and when the machine or rest is not in use, the hole is filled with

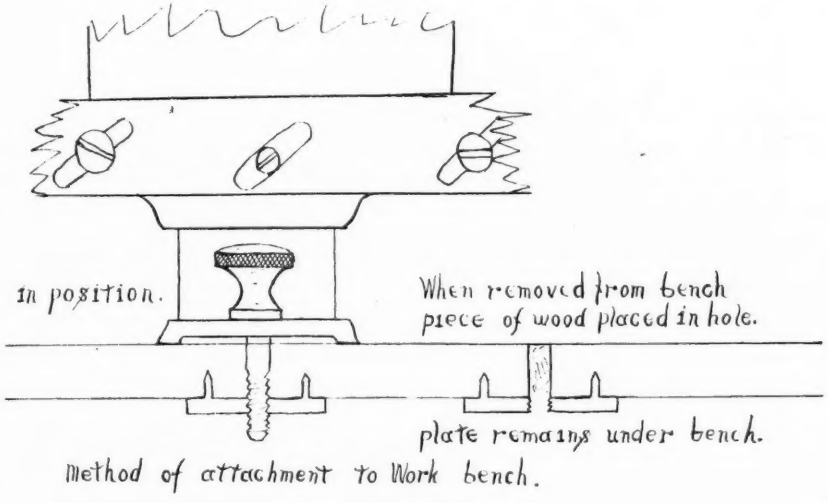


Fig. 3.

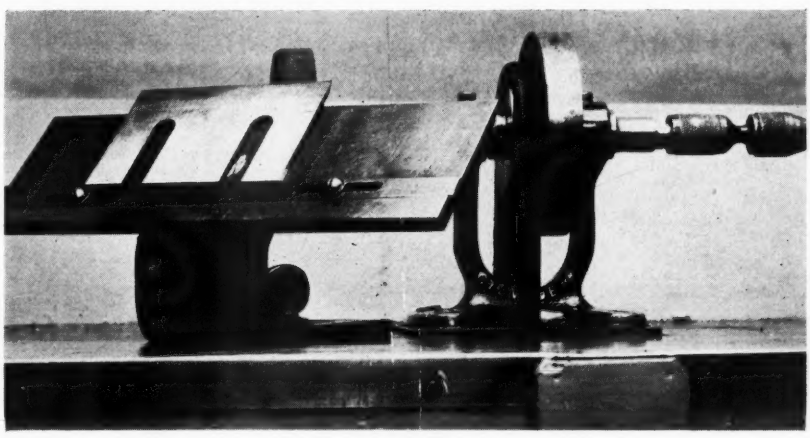


Fig. 4.

a small piece of wood as illustrated in Fig. 3. In Fig. 4 is shown the first model rest attached to a Cleveland dental polishing head, the blade resting against an ordinary carborundum stone. The cup wheel as shown in Fig. 1 is much better, as any degree of hollowness can be ground into the edge of the blade by rotating the slide rest on the clamp screw. The improved model can be supplied to fit any of the dental polishing motors or polishing heads. It is also equipped with a feed screw for raising the blade as it is ground. A blade can be ground to an accurate, keen edge in about five minutes.

THE INLAY ATTACHMENT FOR DEEPLY IMPACTED CANINES*

By Frank Nicolai, D.D.S., Brooklyn, New York

THE purpose of this clinic is to show the security one can obtain when dealing with difficult impactions. There is nothing new or original involved and it is comparatively easy to perform; the general practitioner of dentistry and the orthodontist are using the different principles daily.

The inlay is an 0.040 wire, made of 22 K gold and is one-eighth inch long, to which on one end is soldered a very small extension like a foot, and on the other end an open loop. This is cemented into a specially prepared cavity made in the impacted tooth by means of the Mercitan Injectogun, which enables one easily to carry the unset cement to the surgically exposed tooth and flow it into the bottom of this cavity.

This specially prepared cavity was made by using the following S. S. White Burs, namely, the ½ bur for indenting the enamel of the tooth to the depth of 1/16 inch, the 700 for enlarging, the 557 for giving the cavity the proper size to receive an 0.040 wire, the 35 for undercutting, and the 56 for elongating the round cavity so that the little foot extension can pass into the cavity and with a slight rotation be securely anchored.

After the tooth has been sufficiently erupted, the open loop which was used for the ligature attachments is ground off and the gold wire burnished down just as though it were an inlay.

*Clinic presented at the Twenty-ninth Annual Meeting of the American Society of Orthodontists, Nashville, Tenn., April 8-11, 1930.

DEPARTMENT OF
ORAL SURGERY, ORAL PATHOLOGY AND SURGICAL ORTHODONTIA

THE REPAIR OF CLEFT PALATES AFTER UNSUCCESSFUL OPERATIONS

With Special Reference to Cases With an Extensive Loss of Palatal Tissue*

By Earl Calvin Padgett, M.D., Kansas City, Mo.

IF ONE is a young man and somewhat of a surgical optimist, a review of the measures used in operations on cleft palates is apt to temper one's enthusiasm somewhat, and one may entertain a great many doubts as to the probability of surgical intervention ever attaining its ultimate goal—the ideal functional result—so far as the cleft palate is concerned. In the past many of the great minds in surgery, as a glance at the names which represent the real milestones of progress will reveal, have wrestled ardently with the problem of cleft palate.

In 1764, Le Monnier,[1] a French dentist, reported the first successful repair of a cleft velum. Later, his success was followed by von Graefe[2] of Germany in 1817, Roux[3] of France in 1819 and Warren[4] of America in 1820. But it remained for Dieffenbach to report the first successful closure of both the hard and the soft palate in 1834. Baizeau[5] in 1853 and von Langenbeck[6] in 1861 claimed originality for the operation of Dieffenbach with its lateral incisions. But even today, the operation bears the name of von Langenbeck.

Fergusson has generally received credit for first advocating the severance of the palatal muscles (1845)[7] and also with osteotomy (1873)[8] of the horizontal processes of the palatal bones for relaxation. It appears, however, that Froriep[9] first carried out the former procedure in 1823, and Dieffenbach[10]

*From the Surgical Department of the University of Kansas School of Medicine.

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the latter procedure in 1826. Billroth,[11] in 1861, made the suggestion that the hamular processes be fractured to relieve tension. The use of the mucosal flap from the septum to aid in the repair of the fissure was done first by Lannelonque[12] in 1877. The "criss-cross flap" operation of Davies-Colley[13] for closure of the hard palate appeared in 1890. In 1893, Brophy[14] suggested the wiring operation for bringing the separated alveolar ridges together at an early age. Finally, in 1902, the Lane[15] operation appeared which was an extension of the principle of the Davies-Colley flaps to both the hard and the soft palate.

THE USUAL OPERATIVE PROCEDURES

Practically all the common operations for the repair of complete cleft palates, such as the Lane, Warren and von Langenbeck, have a more or less common fundamental defect. When the palate is being repaired, the mucoperiosteal flaps have to be separated from the palate bones and brought down nearly to a horizontal level to obtain midline closure because the elevation of the horizontal plates of the palate bones on both sides are like the two sides of a raised drawbridge. Thus the upper surface of the freshly repaired hard palate is raw, and as granulation occurs the soft tissues of the hard palate either come up to the horizontal plates or the plates go down to the soft tissues. Probably both movements occur to some extent, especially in the young, but the tendency for the anterior end of the soft palate to be pulled up to the apex of the V formed by the posterior edges of the horizontal plates of the palate bones is always present.

The observance of a few cases of narrow recessive deformity of the maxilla in the adolescent who has undergone an operation in infancy, in whom the alveolar ridges were wired together, warns one to let the maxillary bones alone if possible. Thus the Brophy wiring operation, which necessitates a later operation of the Warren type, is losing adherents. When the surgeons who still adhere to the belief that the early wiring together of the alveolar ridges is a good procedure are excluded, opinion is fairly uniform as to the operative methods to be used and to the necessary essentials preceding closure of the cleft palate in which sufficient tissue is present. In selected cases the Lane operation may be useful, yet because of the likelihood of a slough of the upper flap and the probability that the cicatrix will interfere with mobility of the velum, it is not generally popular. The Warren operation without the lateral incisions gives good results in palates with high vaults and in palates in which the arch of the alveolar ridge has been narrowed by a wiring operation. The von Langenbeck operation with its lateral relaxing incisions, loosening of the raphe at the posterior end of the palatal bones and the preservation of the posterior palatine artery to each flap seems to have withstood the test of time for the routine case and probably is justly the most popular operation for the usual cleft palate.

PALATE LENGTH NECESSARY

Aside from its function of forming a diaphragm between the nasopharynx and oropharynx in the act of swallowing, the palate normally should be able

to form a "flap valve" between the resonating cavities of the nose and the mouth at the moment of the proper articulation of a great many of the consonants—all except m, n and ng. In "cleft palate" speech some of the air which in the articulation of nearly all consonants ought to be expelled through the mouth escapes through the cleft into the nose, where it vibrates in the nasal cavity and finally escapes through the anterior nares. The oral consonants are converted into the voiced nasal consonants and cannot be voiced as loudly, as clearly or as forcibly as they should be.

One of the outstanding needs in surgical intervention of the cleft palate today is a workable procedure which effectually lengthens the soft palate. With this hypothesis in mind, a few clinical experiments were performed on badly damaged palates with the hope that the way to some improvement of the present-day results might become somewhat clearer. The hope was entertained that these badly damaged palates might show sufficient functional improvement after operation to warrant the extension of the same methods to the ordinary case of cleft palate in which operation was not performed or the case in which operation had been done with failure to obtain midline union in which no tissue loss had occurred. As yet, however, the justification for such an extension of the type of operations to be described has seemed questionable.

THE SEVERELY DAMAGED PALATE

Besides patients with the ordinary types of cleft palate in which operations were not performed or the cases in which operations were performed with failure to obtain midline union, but in which no tissue loss has occurred, a number of patients present themselves for repair who have been operated on one or more times previously and in whom there is unmistakable evidence of an old slough. An occasional patient is also seen who shows a marked disuse atrophy of the soft palate which was due to the fact that an operation was not performed at the proper time.

Severely damaged palates have been divided into three groups, as follows: (1) cases in which midline union is probable or has occurred but in which the velum is markedly atrophic or definitely shortened by cicatrix; (2) cases in which after operation the tissue of the hard palate is preserved so that the closure of the hard palate has been obtained or is obtainable, but in which a considerable part of the velum has been lost; (3) cases in which a previous operation has resulted in a sloughing of so much of the tissue of the hard palate and of the soft palate that repair is obviously impossible without the use of tissue from other sources than the mouth.

The obvious need in the palates of the first group is the addition of tissue without interference with mobility so that the velum can come in contact with the posterior pharyngeal wall. In palates of the second and third groups, any soft tissue diaphragm built in to take the place of the soft palate or the whole palate, respectively, which does not obstruct breathing ought to be an aid in closing off the nasopharynx from the oropharynx in the act of articulation.

Most of the patients selected were of the type for whom the usual methods of operation had little to offer. In each case the procedures used for repair, it seemed reasonable to believe, would replace the palatal tissue loss. The results obtained thereby are presented by brief histories of the cases.

REPORT OF CASES

The report of the case that follows represents an effort to solve by operation the problem of the patient with an almost complete loss of the velum

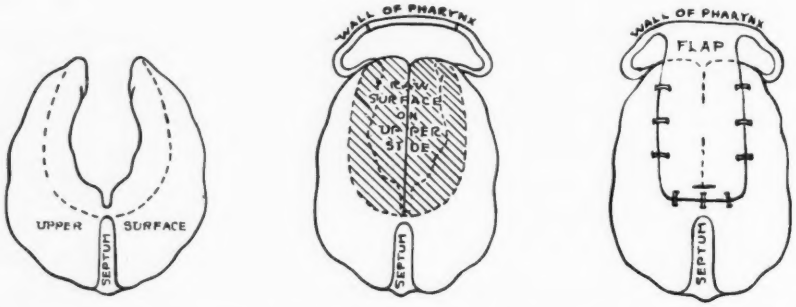

Fig. 1 (Case 1).—Diagram of the upper surface of the soft palate, showing method in which the "shelf" flaps were turned medialward and the position of the pharyngeal flap after it was thrown into the raw area on the upper surface of the palate.

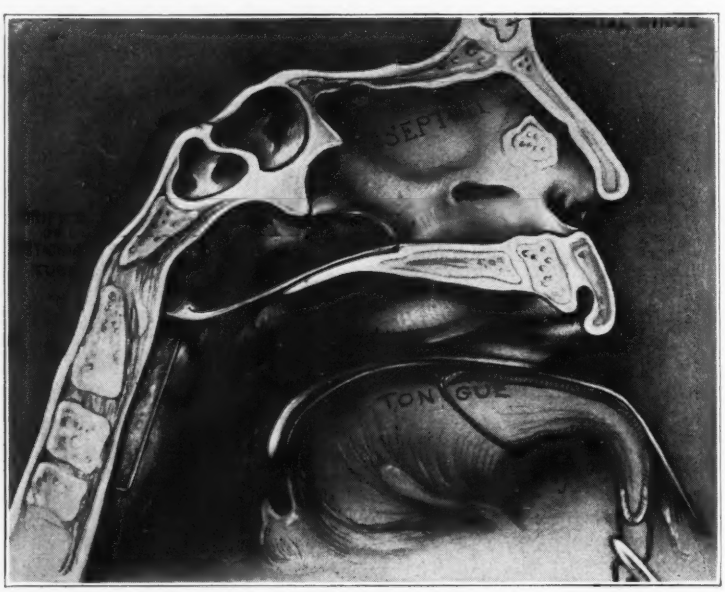

Fig. 2.—Lateral midsection view of the palate, pharynx and pharyngeal flap after it was sewed on the upper surface of the soft palate as in Case 1.

(group 2). It was obviously impossible to repair such a palate without tissue other than that from the palate.

Case 1.—On Nov. 21, 1926, a woman aged twenty-one years was admitted to the Bell Memorial Hospital with the history of four unsuccessful operations on the palate.

From a point opposite the level of the larynx a long pedicled flap of mucosa, about 6 cm. in length by 3 cm. in width, was dissected upward off

the posterior pharyngeal wall in the midline so that the base of the flap was about on a level with the posterior edge of the palate. The flap could then be pulled forward to the posterior edge of the hard palate. From the remnants of the upper surface of the soft palate a semicircular flap was loosened with

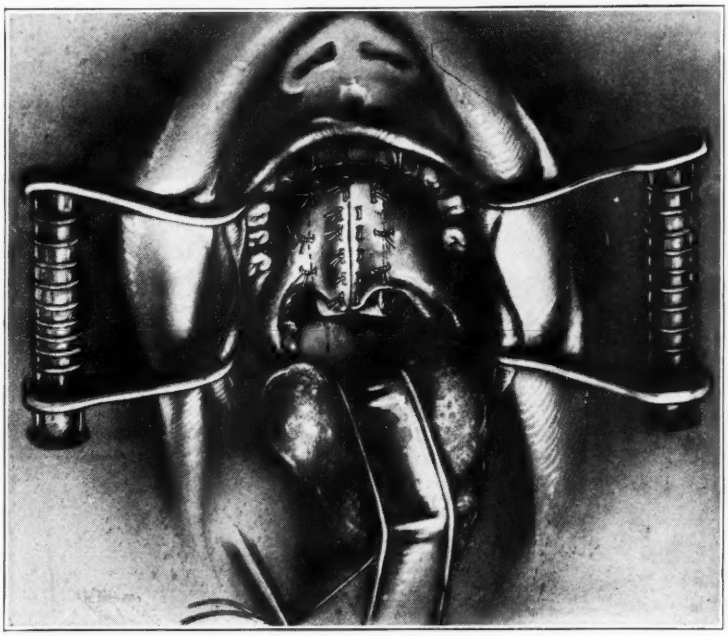

Fig. 3.—The appearance of the soft palate from inside the mouth after the pharyngeal flap was sewed to the upper surface of the soft palate as in Case 1. (In Cases 2, 3 and 4 the methods of turning the flaps were reversed because the latter operation is easier to perform mechanically.)

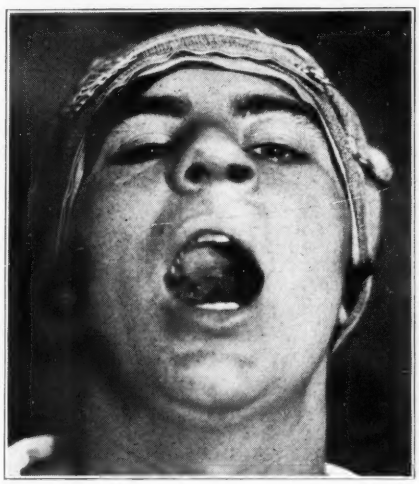

Fig. 4 (Case 1.)—Photograph of the inside of the mouth, taken on July 5, 1929.

a right angled knife and turned downward and toward the midline so that the mucosal covering was adjacent to the tongue. This procedure left a large raw area on the upper surface of the remnants of the velum. The pharyngeal flap was then sewed into this raw defect. Thus a mucosal covering was made for the upper surface of the soft palate. The flaps from the remnants of the

soft palate then were drawn to the midline beneath the pharyngeal flap and the edges were sewed together (Figs. 1, 2 and 3).

On the day following the operation it was noticed, to my great surprise, that the patient articulated her words nearly perfectly. Her speech was improved so startlingly that prematurely the conclusion was reached that the key to the problem of defective speech in cleft palate had been found. But as the flap from the pharyngeal wall gradually tubed itself, although the freedom of the airway improved, her speech was somewhat less perfect. This patient has been followed up for two and a half years. When she has a cold, she has some respiratory difficulty because of accumulated discharge in the nasopharynx, especially at night. Her speech is a little thick and reminds

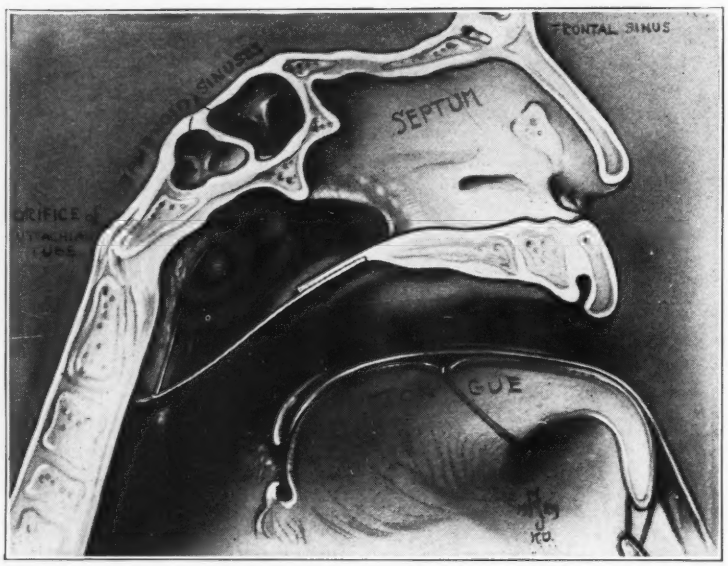

Fig. 5.—Medial cross-section view of the method used when the pharyngeal flap is turned downward. (In Cases 2, 3 and 4 the methods of turning the flaps were reversed, as shown in Figs. 5 and 6 because the procedure is easier to perform mechanically.)

one of speech when the mouth is too full of food, but the "cleft palate" type of speech has been remedied. The improvement in the articulation of her words is really remarkable (Fig. 4).

In Case 2 an attempt was made to improve speech by lengthening the short atrophic velum. This soft palate was typical of the type seen in which operation is postponed until adult life (group 1). A fairly marked disuse muscle atrophy of the velum was present, but there was sufficient palatal tissue to come together in the midline.

Case 2.—On Dec. 19, 1928, a man, aged twenty-three years, entered the Bell Memorial Hospital with a complete cleft of the velum. A pharyngeal flap was turned downward instead of upward, and thus the flap was attached on the under surface of the new velum instead of on the upper surface as in the preceding case. The method of placing the flap in this case was reversed, because technically it is easier to raise the semicircular shelf of flap on the soft palate from the mouth side than from the nasal side (Figs. 5 and 6).

Six weeks later, the pharyngeal flap was detached from the posterior pharyngeal wall. The tail of the flap was cut rather long so that it could be turned over on the upper surface of the velum and doubled on itself to make a thick mass of tissue as wide and as long as possible.

This patient has been followed up for about eighteen months. He is an intelligent person and practices speaking consonants daily with the aid of his wife, who detects changes in sound better than he. Improvement in the articulation of his words is definite.

Following the operations in the first two cases, in February, 1927, a case was reported by Kirkham[16] in which he sutured together the superior constrictor muscle of the pharynx at the sides of the pharyngeal cavity. Speech was nearly normal during the three days that the stitches held. Kirkham was led to believe that the shortening of the loop of the superior constrictor

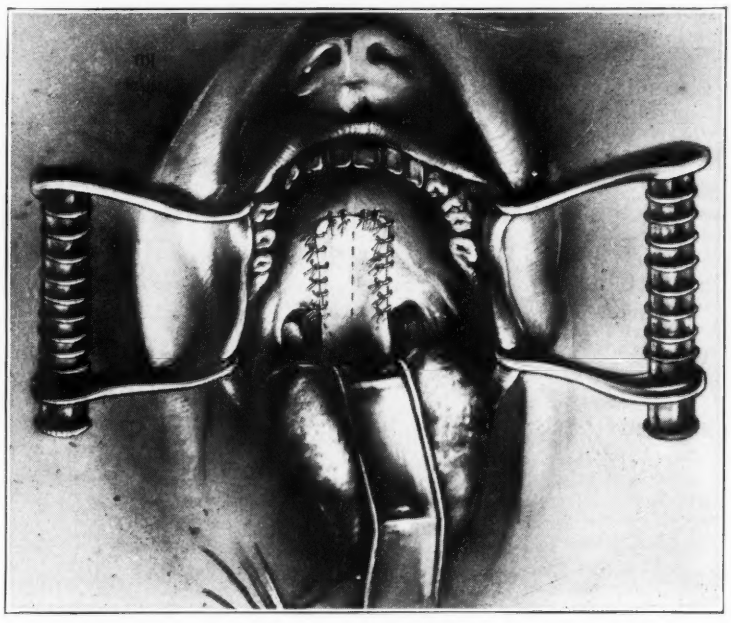

Fig. 6.—View of the palate from within the mouth when the pharyngeal flap is turned downward instead of upward.

muscle was significant and had more of a bearing on correct articulation than heretofore had been thought. Passavant[17] long ago called attention to the hypertrophy of the superior constrictor muscles of the pharynx in the patient with cleft palate. Overdevelopment of the superior constrictor muscle is explained on the basis of its being the only muscle in articulation utilized by the patient with cleft palate to close off the nasopharynx from the oropharynx.

It seems reasonable to attribute some of the improvement in speech experienced by the patient in Case 1 to a tendency of the superior constrictor loop of muscle to be pulled forward somewhat by the flap which connects the velum with the posterior pharyngeal wall. More significant than the tendency of the forward pull, however, and applicable whether the pharyngeal pedicle flap is severed or not, is the narrowing of the pharynx obtained because of the removal of the central mucosal strip.

The third case is an example of rather marked cicatricial contracture of the soft palate with some muscle atrophy (group 1). The hard palate was closed completely except for a small hole in the midline. The velum was separated to within about 1 cm. of the hard palate, was badly scarred and was shortened, and some of it appeared to be missing.

CASE 3.—This patient was two and one-half years old when first seen in Bell Memorial Hospital. Two operations had been performed previously. He was operated upon on Jan. 16, 1928. The velum was rebuilt by the utilization of a pedicled flap from the posterior pharyngeal wall. The pharyngeal flap was turned downward and placed beneath the raw surface formed by the turned up flaps from the soft palate, as in Case 2 (Figs. 5 and 6).

This boy's speech shows improvement; however, he is apparently subnormal mentally, and it is difficult to judge accurately the amount of improvement. He has been followed up for eighteen months. His mother thinks that the improvement in speech has been definite. The pedicled flap still remains attached to the pharyngeal wall.

The patient in Case 4 had suffered from about as much loss of the tissue of the soft palate as the one in Case 1, and falls in group 2 of my classification.

CASE 4.—This patient was operated upon on Aug. 28, 1928, in Bell Memorial Hospital, when three and one-half years of age. He had had three previous attempts at closure of the palate. More than one-half of the soft palate had sloughed. The hard palate, however, was closed. A shelf of mucosa from the remnants of the soft palate was turned upward with the mucosal surface toward the nasal cavity. By swinging a flap from the posterior pharyngeal wall with the pedicle downward to the raw surface of the upturned flaps from the soft palate, a new soft palate of good length and width was constructed, as in Cases 2 and 3 (Figs. 5 and 6).

Improved articulation in this patient was immediate and was fairly marked. He has been observed for ten months. The pharyngeal flap has not been detached from the pharyngeal wall.

OTHER IDEAS ON PALATE LENGTHENING HAVE BEEN ADVANCED

In 1876, Schoenborn[18] advocated the use of a flap from the posterior pharyngeal wall. In 1878, Passavant tied the uvula to the posterior pharyngeal wall by turning small flaps so that raw surface would be to raw surface. The idea was not accepted with enthusiasm, although it was admitted that speech was improved. Sedillot[19] criticized the idea on the basis that surgeons had known that in cases of stricture between the nasal and buccal cavities the nasal type of speech remained. Again, recently, Rosenthal[20] utilized a flap from the posterior pharyngeal wall to repair the velum. Von Kuster's[21] lengthening operation by means of a portion of the detached edge of the cleft also belongs to this group.

In 1922, Blair[22] performed an operation in which flaps from the cheek were outlined and turned in through the lateral incisions on the upper raw surface of the palate anterior to the upper mucosal surface of the velum to

increase the mucosal covering of the upper surface of the palate. This operation lengthens the upper surface of the palate and probably allows the velum to drop down a little.

In 1925, Dorrance[23] described an operation for the lengthening of a palate in which the soft tissue of the hard palate and the raphe of the soft palate are loosened from the horizontal plates of the palatal bones. An encircling incision was made within the alveolar margins, and both the hard and the soft palates were displaced backward. Again, Limberg,[24] in 1927, and Lvoff,[25] in 1928, presented somewhat similar methods. In these operations, even if the flaps of the hard palate did retain their blood supply, it would seem probable that the raw surface between the upper mucosal surface of the velum and the posterior edge of the horizontal plates of the palate bones would simply scar and pull the soft palate back to its former position.

In one of my recent cases (1929) the upper surface of the junction of the hard and soft palates was relined with cheek flaps, as in the operation of Blair, to obtain length of the upper surface of the palate, and the whole palate was pushed back, as in Limberg's operation, to obtain length of the lower surface. This operation appears logical.

NEARLY COMPLETE LOSS OF PALATAL TISSUE (GROUP 3)

In persons in whom only remnants of both the hard and the soft palates remain after operations in which a slough has occurred, a substitute for palatal tissue can be built from tubed pedicled flaps from either the neck or the arm. The paramount question is whether or not a complete new palate built in with inert tissue is of enough functional value to compensate the patient for his trials during a tedious operative procedure.

The brief abstracts of the three cases that follow outline the methods by which such difficult palates can be repaired and give some evidence of the difficulties to be overcome. These cases fall in group 3 of the classification.

In Case 5 the young woman had had several previous operations due to which at least one half of the tissue of the hard palate was absent and practically all of the tissue of the soft palate had sloughed. The tissue loss in this case seemed too great to allow a successful repair by the method of a posterior pharyngeal flap alone. It was decided to use a tubed pedicled flap from the left arm.

CASE 5.—A girl, seventeen years old, was admitted to the Trinity Lutheran Hospital on July 15, 1928. On July 16, the flap was raised from the arm and tubed. On the under surface of the upper end of the flap, which was the part to go into the mouth, a full thickness skin graft was applied. A full thickness skin graft was sewed into the defect on the arm left after the flap was raised. About a week later the upper end of the flap was detached.

On July 28, the flap was sewed in the defect of the palate after shelf flaps were turned upward from remnants of the old palate. A flap was also raised from the posterior pharyngeal wall and sewed to the upper surface of the distal end of the flap that had just been placed in the mouth. A block was wired between the teeth to prevent her from biting the flap, and a cast was

Fig. 7.—The flap one week after it was raised from the arm. At the upper end on the under surface a full thickness skin graft was grown. (This is not visible, however.) Beneath the gauze a full thickness skin graft, which is not visible because of gauze, was sewed into the defect caused by the removal of the flap.

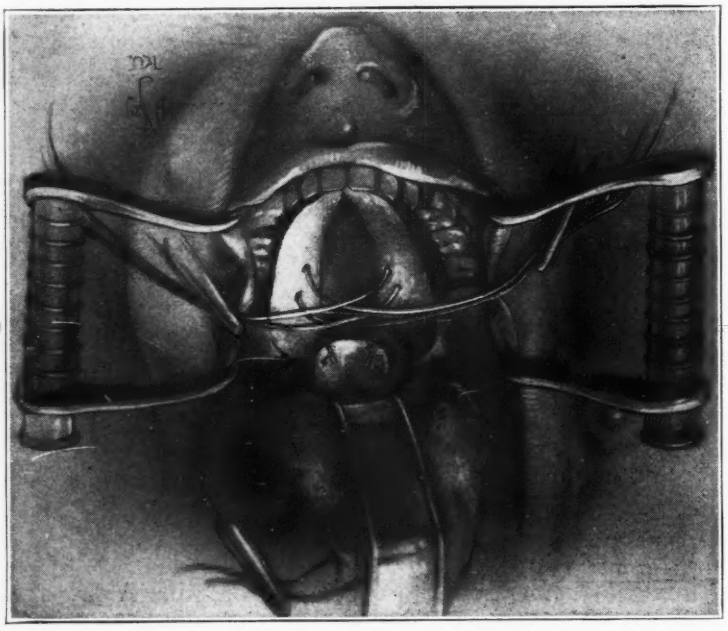

Fig. 8.—The methods of turning the shelf flaps from the sides of the palatal tissues and from the posterior pharyngeal wall. The flap from the arm is then sewed well back into the mouth and put in contact with the raw surfaces.

applied to the head and arm to hold them in proper position. Twelve days later the pedicle of the flap was cut across and the cast removed. One week later, the proximal end of the flap in the mouth was smoothed out and united to the anterior hard palate (Figs. 7, 8, 9, 10 and 11).

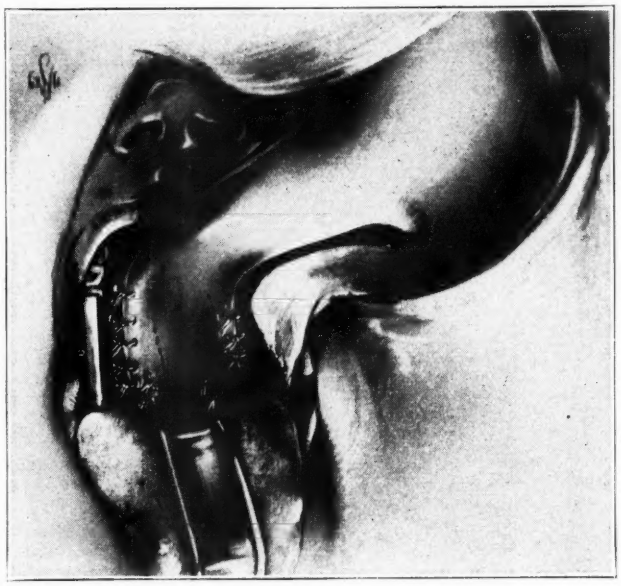

Fig. 9 (Case 5).—The inside of the mouth after the operation was finished. Note that the pharyngeal flap is sewed to the tail of the skin flap from the arm, and the "shelf flaps" of mucosa have been turned upward above the skin flap from remnants of tissue at the side of the palate.

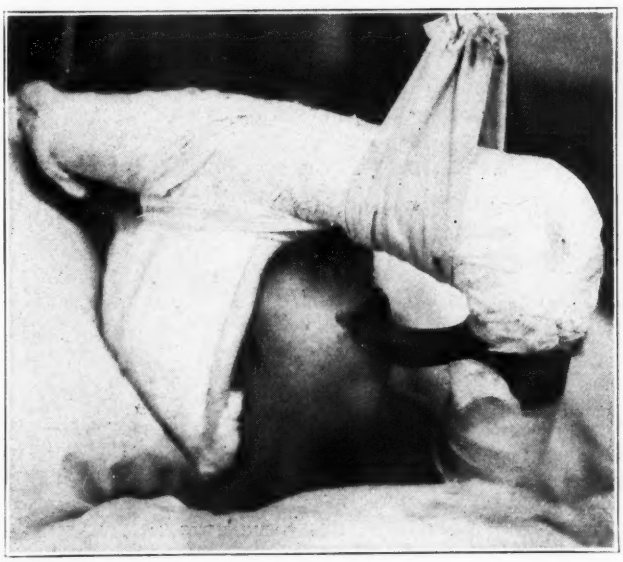

Fig. 10 (Case 5).—A photograph of the plaster cast and flap as thrown into the mouth from the arm.

The girl was intelligent. She had led her class in high school, but because of the defect in speech caused by the palate, she attempted to get along in the world by saying only "yes" and "no," smiling and shaking her head. After the palate was repaired she began to try to talk, and although articu-

lation was imperfect she did show improvement. She is now diligently attempting to overcome her defect in speech by self-training.

When this patient's palate was examined on July 15, 1929, to my surprise it was noted that the new palate contracted and moved. The tissue in the midline, although incapable of movement itself, had evidently been rendered taut by the attachment of the remnants of the palatal muscles at the sides so that when the muscles contracted the whole soft palate showed movement. At this time her speech was remarkably improved. The posterior tip of the new palate was still attached in the midline to the posterior pharyngeal wall. This will be detached at a later date so that the effect on speech can be observed.

The patient in Case 6 had had several previous operations on the palate and practically all of the palate had sloughed. Because of the discomfort of

Fig. 11 (Case 5).—Appearance of patient a few months after operation.

an arm cast, I chose to use a flap from the neck. The alveolar ridge was cleft, so I planned to grow the flap to the lip so that the end beneath the chin could be detached and passed through the cleft. Thus the discomfort of a mechanism to keep his mouth open would not be necessary.

Case 6.—A boy, aged two years, was admitted to Bell Memorial Hospital on Nov. 15, 1928. A flap was raised from the neck and wall of the upper part of the chest with its base beneath the chin. Twelve days later the distal end of the flap was turned upward and attached beneath the upper lip. Thus a "jump flap" was made of it. About this time the patient developed influenza and ran a fever for about a week. It was suggested to his mother that she take him home at this time. However, as she was somewhat sensitive about his appearance, he was kept at the hospital. He should have gone home at this time for a long rest and complete recovery. On Feb. 8, 1929, the "jump flap" with its pedicle beneath the upper lip was turned into the mouth through the cleft alveolar ridge. The flap grew perfectly, but considerable trouble

was experienced in getting the child to eat. He had practically a normal temperature after the first two or three days following the operation. Laboratory observations were negative except for a hemoglobin of 50 per cent. A transfusion was given, after which he began to eat a little and to sit up in

Fig. 12 (Case 6).—Appearance of patient after the flap had been raised from the neck.

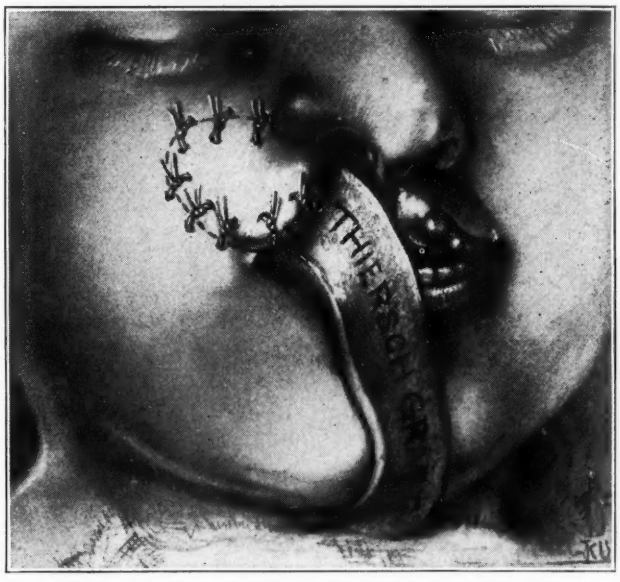

Fig. 13 (Case 6).—A drawing of the flap after it had been attached beneath the upper lip and its raw surface had been grafted by the Thiersch graft.

bed. On the evening of February 20, twelve days after operation, the nurse took him in her arms and gave him a feeding, after which she left the ward. She returned in about fifteen minutes and he was dead. No autopsy could be obtained.

The exact cause of the boy's death remains uncertain, but a lesson should be learned. He should have been given two or three months' rest to improve his condition before the flap was placed in the mouth. Perhaps it might have been better judgment to have postponed the operation until the child was several years older (Figs. 12, 13 and 14).

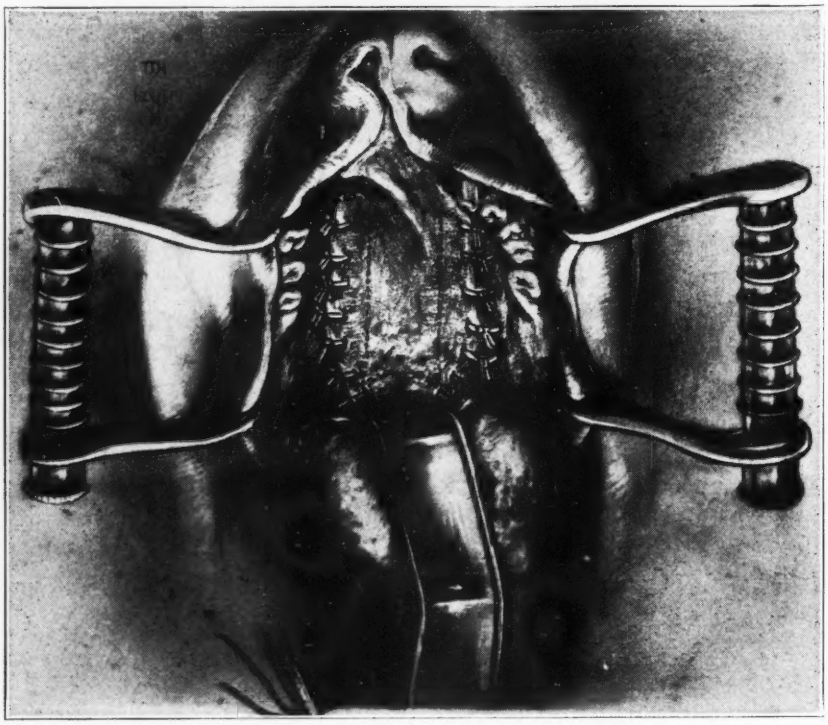

Fig. 14 (Case 6).—A drawing of the "jump" flap after it had been severed from the neck and turned in to build the new palate. Note the side "shelf" flaps and the posterior pharyngeal flap turned on the upper surface of the skin flap.

Fig. 15 (Case 7).—Appearance of patient after the flap had been sewed into the mouth. The patient's mouth is held open by a triangular edge of wood which is wired between the teeth.

The patient in Case 7 was twenty-one years old and had undergone several operations on the palate in babyhood, after which the hard and soft palates had sloughed almost completely.

CASE 7.—On June 17, 1929, in Trinity Lutheran Hospital, a flap was raised from the left arm and tubed. On July 2, the flap was placed in the mouth in a manner similar to that used in Case 5. On the second night after operation, a tracheotomy was done because of laryngeal edema.

For a few days following the tracheotomy he had a temperature of 103.5° F. which gradually subsided. After two weeks, the flap was cut next to the arm and the plaster fixation was removed. Two days after this he was sent home for two weeks. After this time he reentered the hospital to have the anterior end of the flap smoothed out and attached within the alveolar curve. He left the hospital five days later (Figs. 15 and 16).

It is possible that a tracheotomy should be a part of this operation, unless an experienced nurse is in constant attendance. If a tracheotomy is not made at the time of the original operation, the instruments necessary to do a

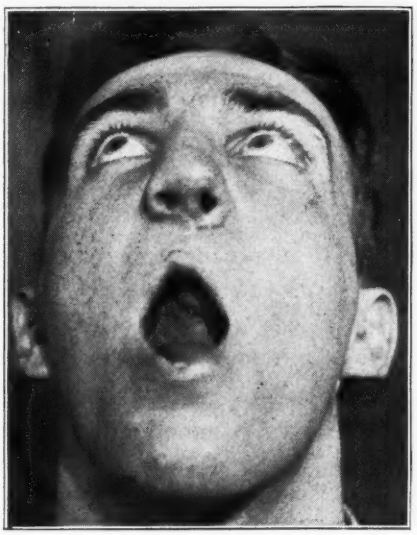

Fig. 16 (Case 7).—As much of the new palate as could be shown by a photograph, two months after operation.

tracheotomy should be kept at the bedside for the first few days. At the present time (Sept. 20, 1929) this patient is at work and his speech is nearly normal. The nasal tone has disappeared from his speech. The posterior part of his palate moves slightly when he swallows or speaks. The flap is still attached to the posterior pharyngeal wall in the midline.

PREVIOUS USE OF PEDICLED SKIN FLAP

The idea of the repair of a palatal defect by a flap from elsewhere than inside the mouth is rather ancient. It was first unsuccessfully attempted by Blasius[26] by the use of a flap from the neck. Thiersch,[27] in 1867, and Rotter,[28] in 1869, used the principle successfully. Later the method was successfully used by von Eiselberg[29] and Blair.[30]

SUMMARY

By the use of a pedicled flap from the posterior pharyngeal wall a method is presented which will lengthen somewhat the short velum with-

out narrowing the nasopharynx or oropharynx sufficiently to interfere with the function of breathing or swallowing. The lengthening of the velum and the narrowing of the oropharynx obtained have improved speech and aided particularly in the articulation of the oral consonants in the persons so far observed. A pedicled flap from the posterior pharyngeal wall can be used in the successful reconstruction of a diaphragm of tissue between the nasopharynx and the oropharynx and is particularly applicable to those cases in which a considerable part of the velum has sloughed. In the past, such persons have usually been advised that surgical intervention has nothing to offer. The results reported definitely contradict the truth of such a hopeless verdict. The functional results in this group (group 2) are particularly satisfactory and hopeful. It is possible to use the pedicled flap from outside the mouth to repair this type of palate, but the procedure necessitates several operations and is far more difficult for both the patient and the surgeon.

For the repair of the palate in which most of the tissues of both the hard and the soft palate have sloughed (group 3), a pedicled flap of skin and subcutaneous tissue from the arm or neck can be used. Obviously sufficient tissue to repair this extensive defect must be obtained elsewhere than from inside the mouth. Although the tediousness of this procedure is admitted, the results in the preceding cases indicate that a diaphragm of skin and subcutaneous tissue is better than no palate or an obturator and is distinctly worth while. The movement of the new palate obtained after transplantation of a flap from the arm (Cases 5 and 7) gives proof of the ability of the remnants of the palatal muscles which are attached at the sides of the new palate to move the central flap somewhat. The amount of this movement will probably depend upon the amount of good muscle available for insertion at the sides. Thus the principle of the application of a pedicled flap from outside the mouth to repair a gross loss of palatal tissue places at the surgeon's command a final method, by the use of which, it can be said with truth, a defect of the cleft palate does not exist in which surgical intervention has nothing to offer, provided enough tissue remains within the alveolar curve to serve as a raw base of sufficient width to obtain union after the skin flap is sutured in place.

REFERENCES

1. Le Monnier, quoted by Robert: Memoires sur different objet de medicin, Paris, 1764, Masson & Cie; quoted by Verneuil, A. S. S.: Memoires de chirurgie, Paris, 1877-1878, vol. 1, p. 506, Masson & Cie.
2. Von Graefe, C.: Die Gaumennaht, ein neuentdecktes Mittel gegen angeborene Fehler der Sprache, J. d. Chir. u. Augenh. **1**: 556, 1820.
3. Roux, P. J.: Memoires sur la staphyloraphie, Arch. gén. de méd. **7**: 516, 1825.
4. Warren, John C.: On an Operation for the Cure of Natural Fissure of the Soft Palate, Am. J. M. Sc. **3**: 1, 1828.
5. Baizeau, quoted by Verneuil, A. S. S.: Memoires de chirurgie, Paris, 1877-1878, vol. 1, p. 506, Masson & Cie.
6. Von Langenbeck, B.: Operation der angeborenen totalen Spaltung des harten Gaumens nach einer neuen Method, Deutsche Klinik **12**: 231, 1861; Weitere Erfahrungen im Gebiete Urano-plastik mittelst Ablösung des mucösperiostalen Gaumenüberzuges, Arch. f. klin. Chir. **5**: 1, 1864.
7. Fergusson, William: Observations on Cleft Palate and on Staphyloraphie, Tr. Med. Soc.-Chir. **28**: 273, 1845; On Cleft Palate and on Staphyloraphie, Med. Times **16**: 25, 1847; On Hare-Lip and Split Palate, Lancet **1**: 719, 1864.

8. Fergusson, William: A New Operation for Cleft Palate, Lancet **11**: 784, 1873; Successful Treatment of Four Cases of Cleft in the Hard Palate by a New Operation, ibid. **1**: 298, 1874.
9. Froriep: "Nottizen" chirurgische Kupfertafln, Weimer, 1823.
10. Dieffenbach, J. F.: Chirurgie Erfahrung, 1834, No. 324, p. 168; Die Operative Chirurgie, Leipzig, 1845, F. A. Brockhaus.
11. Billroth, T.: Ueber Uranoplastik, Wien. klin. Wchnschr. **2**: 241, 1889.
12. Lannelonque: De l'uranoplastic osteo-muqueuse, Bull. et mem. Soc. de chir. de Par. **111**: 467, 1877.
13. Davies-Colley, T. N. C.: On a Method of Closing Cleft of the Hard Palate by Operation, Brit. M. J. **11**: 950, 1890.
14. Brophy, T. W.: Brophy's Operation for Cleft Palate, in Catching: Comp. Pract. Dent. Atlanta, 1894, vol. 258, p. 262; Proc. Third Internat. Dent. Cong. **152**: 153, 1900; quoted by Stone, in Bryant and Buck: American Practice of Surgery, New York, 1908, William Wood & Company; from Park: Surgery, Philadelphia, 1893, Lea Brothers & Company.
15. Lane, W. A.: On Cleft Palate, Lancet **11**: 433, 1902.
16. Kirkham, H. L. D.: Preliminary Paper on Improvement of Speech in Cleft Palate Cases, Surg. Gynec. Obst. **44**: 244, 1928.
17. Passavant, G.: Ueber die Beseitigung der naselnden Sprache bei angeborenen Spalten des harten und weichren Gaumens, Arch. f. klin. Chir. **6**: 333, 1865.
18. Schoenborn: Ueber eine neue Methode de Staphlorhaphie, Arch. f. klin. Chir. **19**: 528, 1876.
19. Sedillot, C., quoted by Christopher Heath, in John Ashhurst: The International Encyclopedia of Surgery, New York, 1889, vol. 4, p. 911, William Wood & Company.
20. Rosenthal, W.: Pathologie und Therapie der Gaumendefelste, Fortschr. Zahnh. **4**: 1021, 1928.
21. Von Kuster: Den Operation der complizierten Hasenscharte, Zentralbl. f. Chir. **32**: 713, 1905; Ueber die Operative Behandlung der Gaumenspalten, Arch. f. klin. Chir. **46**: 215, 1893.
22. Blair, V. P.: Personal communication to the author.
23. Dorrance, George M.: Lengthening of the Soft Palate in Cleft Palate Operations, Ann. Surg. **82**: 208, 1925.
24. Limberg, A.: Innovations in Operative Methods, Zentralbl. f. Chir. **54**: 1745, 1927.
25. Lvoff, P. P.: Operation for Lengthening Palate, Vestnik khir. **13**: 212, 1928.
26. Blasius, quoted by von Eiselberg, Frederick: Zur Technik der Uranoplastik, Arch. f. klin. Chir. **64**: 509, 1901.
27. Thiersch, C.: Verschluss eines Loches un harten Gaumen durch die weichtheile der Wange, Arch. f. d. Heilkunde **9**: 159, 1868.
28. Rotter, Julius: Deckung eines Defectes un harten Gaumen mittelst eines Sternlappens, München. med. Wchnschr. **36**: 535, 1889; Plastische Operation an der Mundhöhle und in der Nase, Verhandl. d. deutsch. Gesellsch. f. Chir., 1889.
29. Von Eiselberg, F.: Zur Technik der Uranoplastik, Arch. f. klin. Chir. **64**: 509, 1901.
30. Blair, V. P.: Operative Treatment of Difficult Cases of Palate Defects After Infancy, Surg. Gynec. Obst. **12**: 289, 1911.

DISCUSSION

Dr. Frederick A. Figi, Rochester, Minn.—I believe that the ingenious procedure which Dr. Padgett has presented for taking care of some of the difficult postoperative cleft palates, that is, the use of a flap from the posterior pharyngeal wall, is a real contribution. This should prove of decided value in taking care of some of the bad postoperative cases. At The Mayo Clinic, in the ordinary run of primary cases of cleft palate, our routine procedure has been the von Langenbeck operation to which he referred. Those patients presenting unusually wide defects, whether primary or due to postoperative loss, are taken care of with the two-stage delayed flap operation described by New in 1922. This consists of elevating the soft tissues on either side of the defect by means of a long lateral incision just inside the alveolar border. The double pedicled flap thus formed is crowded toward the midline by means of an iodoform gauze pack on either side. After from five days to a week the margins of these flaps are pared and sutured. In cases presenting still wider defects, an attempt is made to close the hard palate only in this manner at the first series of operations, the soft palate being closed by a similar two-stage procedure after several months. The length of the lateral incisions does not appear to have a direct bearing on subsequent palatal function, even in those cases in which the incisions are extended laterally around the tuberosity and well back into the commissure. Transforming the tensor palati into a levator by breaking off the

hamular process of the external pterygoid plate, as suggested by Dorrance and others, also at times assists in securing relaxation without subsequent interference with function. Multiple stage operations must, of course, be attended by the production of a greater amount of scar tissue and thereby increased rigidity of the palate. However, we have seen no appreciable difference in the function of palates closed in this manner in comparison with those in which we have secured primary union. This multiple stage operation will permit of closure of many of the bad postoperative cases in which primary closure is entirely out of the question. I believe that this should be tried in preference to the use of a flap from the posterior wall if it appears at all advisable, for a closure obtained in this way will give an incomparably better functioning palate than one into which inert tissue has been introduced. Personally, I cannot become enthusiastic over the use of cutaneous flaps for the closure of wide palatal defects, even though the case may be hopelessly inoperable otherwise. The advantage of the introduction of this inert mass of tissue into the palate appears questionable to me in view of the difficulties associated with the operation and the hazards involved, in comparison with the ease of closing such a defect satisfactorily with an artificial velum.

STERILIZATION FOR SURGERY OF THE MOUTH

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(Continued from page 1215, November issue.)

BOILING IN WATER

Most authorities state that non-spore-bearing organisms are killed by boiling for ten minutes. A few have reported organisms of this class that have resisted boiling for from thirty to sixty minutes. Though my experiments show sterilization in shorter time, a period of ten minutes boiling is recommended,

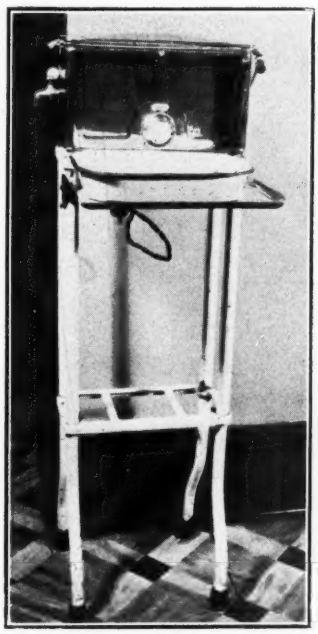

Fig. 31.—Small electric sterilizer for boiling syringes or small instruments.

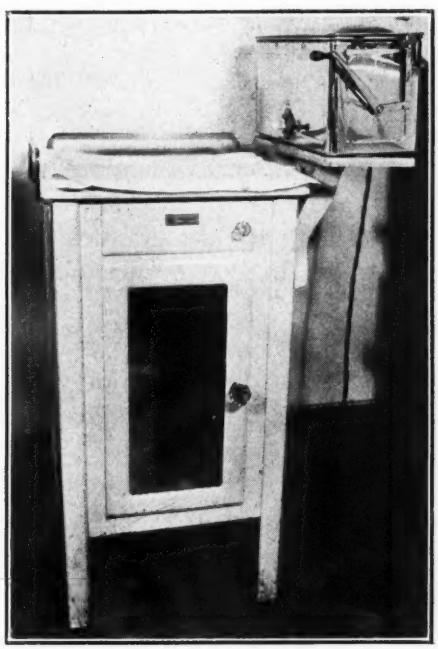

Fig. 32.—Electric sterilizer for boiling instruments.

to provide an ample margin on the side of safety. A small amount of alkali, such as sodium carbonate, or sodium hydroxide, should be added to the water to prevent rusting of instruments.

USE OF BOILING WATER

If used immediately after the heat is cut off and in quantity sufficient to guard against a rapid cooling, this method is nearly the equivalent of boiling, so far as practical results are concerned. The use of one gallon of water, boiled until the moment before the instruments are submerged in it, sterilizes as rapidly as does boiling, at least during the first five minutes of exposure. If care is taken to carry out this procedure fully, the method is efficient, the

advantages and the disadvantages are the same as with boiling, save that the rapid cooling of the water will necessitate reheating to the boiling point to insure proper results.

The use of water at too low temperature or for too short a period of time makes possible incomplete sterilization. As the temperature is lowered, the period of exposure must be lengthened; but, as the loss of heat is uncertain, the required length of exposure will necessarily be uncertain. On account of the uncertainty of the temperature of the water, unless it is boiled immediately prior to use on each occasion, this method is not so good as boiling or the use of a known temperature at a degree lower than the boiling point.

STERILIZATION BY DIRECT FLAME

This method is not applicable to most surgical instruments, as flaming will discolor and injure them. It is applicable to platinum wires or loops for cultures, iridium platinum, and special needles for local anesthesia work, burning of alcohol solution off lights used for transillumination work and in burning alcohol off instruments used in cultural work, etc.

STERILIZATION BY CHEMICALS

At this point it will be well to consider the subject of chemical germicides.

Alcohol, although popular, is not dependable. Mallory and Nye reported in 1923 two postoperative deaths due to *B. aerogenes capsulatus* which had not been killed by twenty minutes' exposure to 70 per cent alcohol. They subsequently found that even exposure for one hour failed to kill bacilli of this group.

The method of carbolic acid followed by alcohol consists of submersion of the instruments in phenol of varying strength. The solubility of phenol in water is about 1 part in 20, giving a 5 per cent solution. This solution is more effective than the pure phenol. After the instruments are submitted to this treatment, they are immersed in alcohol to remove the excess of phenol and may then be rinsed in water or used without rinsing.

With many strains, ten minutes' exposure to 5 per cent phenol followed by one minute in alcohol sufficed to sterilize. Some strains of staphylococci, however, were more resistant and uniformly gave growth after fifteen minutes, in a portion of the tubes even after thirty and forty-five minutes' exposure. No strain which was used survived one hour in 5 per cent phenol. The same resistant strain was uniformly killed by boiling for three minutes. It was also killed by three minutes' exposure in an 80° water-bath.

Hasseltine suggests that those instruments not to be sterilized by heat should be placed in phenol solution and rinsed in alcohol. However, in the tests which he made using 5 per cent phenol as a disinfectant, he recovered staphylococci after forty-five minutes of exposure to the carbolic acid. Phenol is not to be recommended, therefore, when time is an important factor, as the sixty minutes' immersion suggested by Hasseltine cannot safely be shortened.

The use of other coal-tar products resembles that of phenol in application and efficiency. The advantages and disadvantages mentioned under phenol apply also to these products, except as follows: (a) some have a higher coefficient

than phenol; that is, they are more germicidal than phenol; (b) some have a soapy composition, giving them the cleansing property of soap when mixed with water.

In our own laboratory, working with mixed cultures of normal mouth bacteria, and with three sterilizing solutions, 70 per cent alcohol, metaphen, and Bard-Parker germicide, we found the Bard-Parker germicide to be the most efficient and dependable *chemical* agent for sterilization of dental instruments. Fine cutting edges are apparently unharmed by any of the three solutions, although it is the experience of some operators that prolonged immersion in alcohol will eventually corrode a steel blade. We did not find any signs of discoloration or corrosion of steel blades after three weeks' immersion in Bard-

TABLE XVIII

CHEMICAL STERILIZING FLUIDS

Experiment I.

Material:

(a) Centrifuged growth of three old broth cultures of normal mouth bacteria.

(b) Agar slant of mixed cultures of normal mouth bacteria.

Method: Sterile swabs rolled in (a) and then in (b); dipped in blood; dried two hours at 37 degrees; immersed in sterilizing fluids and then dropped into tubes of dextrose broth.

TIME	Incubation	1 MINUTE	3 MINUTES	5 MINUTES
Bard-Parker solution	24 hour	−	−	−
	48 "	−	−	−
Metaphen	24 "	++	+	+
	48 "	+++	++	+
Alcohol, 70%	24 "	++++	+++	+++
	48 "	++++	+++	+++
Control		++++		

TABLE XIX

CHEMICAL STERILIZING FLUIDS

Experiment II.

Material: 6 strains of anthrax, from the hygienic laboratory, grown on agar in tubes, and being at least a month old, exhibiting a heavy growth on the top of the media.

Method: The three chemical sterilizing solutions being tested were used. Each fluid was poured into tubes (two) of the old anthrax cultures, to cover the heavy growth with a fluid layer about 1 cm. in depth. At certain time intervals, agar plates were inoculated from the submerged cultures, a sterile loop being used to pass through the solution and withdraw a small portion of the heavy growth of anthrax which was rinsed in sterile water before being transferred to the agar plate.

SOLUTION	NO. OF CULTURE	LENGTH OF TIME IMMERSED IN FLUID				
		15 MIN.	45 MIN.	1¼ HR.	1½ HR.	2 HR.
Bard-Parker	149	+	+	+	−	−
	153	+	+	+	+	+
Metaphen	151	+	+	+	+	+
	154	+	+	+	+	+
Alcohol, 70%	152	+	+	+	+	+
	415	+	+	+	+	+

Part 2. Cultures made in dextrose broth from the above tubes, thirty-six hours after immersion started.

SOLUTION	HOURS INCUBATION AFTER INOCULATION			
	24 HR.	48 HR.	72 HR.	96 HR.
Bard-Parker	−	−	−	−
Metaphen	−	−	−	−
Alcohol, 70%	−	−	+	++

Parker solution in a covered glass jar, and the bactericidal action of the Bard-Parker germicide was without question more energetic than that of the other two fluids. Sterile swabs, heavily coated with a mixed growth of normal mouth

TABLE XX

CHEMICAL STERILIZING FLUIDS

Experiment III.

Material: Old dental instruments. Cultures of B. anthracis and B. subtilis. 3 germicides.

Method: Old dental instruments were liberally inoculated with month-old cultures of the two spore-bearing bacilli. (The cultures were not mixed. The anthrax were put on some instrument and the B. subtilis on others.) The inoculated points were then dipped in blood, and then dried in the incubator for four hours. One instrument with each type of bacillus was put in each of the three types of fluids. At the end of one and of one and one-half hours agar plates were inoculated from the instruments, excess solution being rinsed off with sterile water.

SOLUTION	B. ANTHRACIS		B. SUBTILIS	
	1 HOUR	1½ HOUR	1 HOUR	1½ HOUR
Bard-Parker	–	–	–	–
Metaphen	+	–	+	–
Alcohol, 70%	+	+	–	+

TABLE XXI

CHEMICAL STERILIZING FLUIDS

Experiment IV.

Materials: One spore-bearing culture each of B. anthracis and B. subtilis.

Method: Sterile swabs rolled in agar cultures of B. anthracis and B. subtilis. Dried in the incubator at 37 degrees for one hour. Two swabs immersed in each of three solutions being tested. At end of one and of one and one-half hours remove one swab from each type of germicide and drop into sterile dextrose broth in tubes. Incubate for forty-eight hours.

SOLUTION	HOURS INCUBATION	HOURS IMMERSION IN GERMICIDE	
		1 HOUR	1½ HOUR
Bard-Parker	24	–	–
	48	–	–
Metaphen	24	–	–
	48	–	–
Alcohol, 70%	24	–	–
	48	+	+
Control	24	++	
	48	++++	

TABLE XXII

CHEMICAL STERILIZING FLUIDS

Experiment V. The efficiency of germicides after three weeks' exposure to the air.

A. Modified Reddish Germicidal Test.

Material:

(a) Bard-Parker solution and metaphen, both of which had stood in a shallow layer in a glass receptacle (uncovered) at room temperature for three weeks.

(b) Twenty-four-hour dextrose broth culture of normal mouth bacteria, staph., strep., and bacilli.

Method: 0.2 c.c. of the broth culture was added to 2 c.c. of each of the solutions to be tested. Tubes of dextrose brain broth were inoculated from these tubes at definite intervals, and incubated for forty-eight hours at 37 degrees.

SOLUTION		EXPOSURE TO GERMICIDE		
		1 MIN.	5 MIN.	10 MIN.
Bard-Parker	24 hr.	–	–	–
	48 hr.	–	–	–
Metaphen	24 hr.	–	–	–
	48 hr.	–	–	–

TABLE XXIII

CHEMICAL STERILIZING FLUIDS

Experiment V. (Continued)

B.

Material: Bard-Parker solution and metaphen, both of which had stood in a shallow layer in a glass receptacle (uncovered) at room temperature for three weeks.

Method: Sterile swabs were rolled in the sediment from a twenty-four hour dextrose broth culture of normal mouth bacteria, staph., strep., and bacilli. They were dried in the incubator for two hours and then immersed in the solutions being tested. At the end of definite periods, a swab from each solution was withdrawn and the end clipped into a tube of dextrose brain broth, and incubated for forty-eight hours at 37°.

SOLUTION		TIME IMMERSED IN SOLUTION	
		2 MINUTES	10 MINUTES
Bard-Parker	24 hr.	–	–
	48 hr.	–	–
Metaphen	24 hr.	–	–
	48 hr.	++	–
Control	24 hr.	++++	
	48 hr.	++++	

NOTE.—After FOUR days of incubation, the tube which had been inoculated with the swab which had stood for ten minutes in the metaphen, gave a ++ reading. The two tubes inoculated with swabs immersed in Bard-Parker solution gave negative readings even after six days incubation.

TABLE XXIV

STERILIZING FLUIDS

Experiment VI. The effect of prolonged exposure on the cutting edge and plating of instruments.

A. New chisel knives, heavily plated, were immersed in the three solutions under test (Bard-Parker, metaphen and 70 per cent alcohol) in open test tubes and allowed to stand at room temperature for three weeks (4/14/30 to 5/8/30). Except for a somewhat sticky feel to the knife which had been in metaphen no injurious effect was noted on any of the knives.

B. New thin blades, showing no signs of corrosion or rust, were immersed in Bard-Parker solution and in metaphen in open test tubes and allowed to stand at room temperature for eighteen days (5/8/30 to 5/27/30). At the end of this time no signs of corrosion or rusting were visible on either of the knives. Even after rinsing, however, there remained a slightly sticky feel to the blade which had been in the metaphen. Some test of the cutting power of knives after different forms of sterilization would be very valuable.

TABLE XXV

STERILIZING FLUIDS

Experiment VII. The irritating effect of various sterilizing fluids on human skin.

In comparing the irritating effects of three types of sterilizing fluids it was found that the human skin of the forearm is much more sensitive to Bard-Parker solution than to either 70 per cent alcohol or undiluted metaphen. A wet compress of alcohol or of metaphen may be applied and kept moist for several hours at a time without causing any feeling of irritation at the moment, and without producing any after-effects other than a dryness of the skin of the involved area. Within two minutes of the application of a moist compress of Bard-Parker solution, however, there is noted a feeling of itching and burning under the compress. This sensation persists as long as the compress is left on the arm. After an hour's exposure to such a condition, the resulting area of redness and dryness will persist for over twenty-four hours, and after only a few minutes' exposure there are distinct signs of irritation for several hours, with the persistence of the dry, scaly appearance for at least a day.

The odor and slightly irritating effects of the Bard-Parker solution upon the operator's eyes, etc., is somewhat objectionable. When this solution is dropped upon scratches or cuts, it is extremely irritating. All three of these solutions evaporate, which, of course, is some disadvantage. As an experiment we placed 8 ounces of 70 per cent alcohol, metaphen, and Bard-Parker solutions each in a separate glass container with a glass lid and removed the lid only when instruments were needed during the day. At the end of seven days we found that one ounce of the Bard-Parker solution had evaporated and also one ounce of the alcohol. There was no appreciable evaporation of the metaphen, but the instruments in it after a week's time were discolored and very gummy, and the solution was changed in appearance.

bacteria, dipped in blood, and dried in the incubator at 37°, repeatedly yielded sterile cultures in dextrose broth, after one minute's immersion in Bard-Parker solution; whereas, following five minutes' immersion in alcohol and metaphen, a luxuriant growth was produced in the broth, within twenty-four hours. Therefore, until some other equally efficient or better chemical sterilizing fluid is called to our attention, we recommend ten minutes' immersion in Bard-Parker solution as a method of sterilizing instruments where a *chemical* is the method used.

THE QUESTION OF SPORE-BEARING BACILLI

The fact that both dental and surgical men generally seem to overlook the possibility of infection from the resistant spore-bearing organisms may seem inexcusable when the question of sterilization is first attacked. After a brief study of the situation, however, one sees that it is obviously foolish to insist upon a type of sterilization severe enough to kill the spores of those organisms when the chances of infection from that source are almost negligible. There are certain facts about spore-bearers which must be noted. The spore is a highly refractile body, surrounded by a thick membrane. It develops within the cell of certain bacteria, differentiated from those bacteria which (as far as is known) never develop such spores, by the terms, spore-bearing bacteria and non-spore-bearing bacteria. The cell eventually degenerates and the spore remains, apparently lifeless, although capable of growth as soon as favorable conditions are found. In this apparently lifeless stage, the spore is highly resistant to heat and chemicals; it has no means of attaching itself to any spot and as a consequence is very easily moved from place to place by mechanical means. It is this fact which makes thorough scrubbing in running water a greater safeguard against infection from spore-bearers than long periods of immersion in boiling water. A few years ago there was an epidemic of anthrax infections occurring from the use of new, unsterilized shaving brushes. *Bacillus anthracis* were cultured from these brushes, but a thorough washing in hot, soapy water was all that was necessary to render them safe for use. The appearance of the spores on the brushes was due to the fact that anthrax is primarily a disease of domesticated animals, and its occurrence in man has been chiefly among those working with infected meat, or with hides or wool of infected animals; in this case, with hair or bristles.

Another point to remember is that the vegetating forms of the spore-bearing organisms are killed as easily as are the non-spore-bearing pathogens, and the special conditions necessary before a spore-bearing bacteria will produce spores are not always obtained. Thus, the spores of *Bacillus anthracis* develop best at a temperature of 30° C. and do not form at temperatures above 43° C. Also they never form in an intact animal body. An accidental infection of anthrax, then, would indicate that the spores came from a temporary resting place on part of the office equipment rather than from a patient.

Anthrax is the only one of the aerobic spore-bearing bacilli of medical importance. Of the anaerobic spore-bearers, *Bacillus tetani, Bacillus saprogenes, Bacillus botulinus, vibrion septique and Bacillus Welchii,* all except *Bacillus botulinus* are common inhabitants of the intestinal tract of man and other animals and commonly occur in fertilized soil. Stitt says, "The spores of most

of these anaerobes develop in the intestinal lumen and in this resistant stage may remain viable for years in the soil. In Flanders, the soil was heavily contaminated and the clothing of the soldiers, spattered with the spore-containing mud, furnished infectious material ready to be inoculated by shells or other agents.'' Anaerobes, of course, grow only in oxygen-free surroundings, and spores of the spore-bearing anaerobes, although almost omnipresent in the soil, must be inoculated deeply and the wound closed to shut out oxygen before the spores will develop and cause infection. Because of the rarity of these spores in such a place as a dental office and because of the special conditions which must obtain for their formation and for their growth, strict cleanliness and surgically aseptic methods should protect the dentist from accidentally infecting a patient with any of the pathogenic spore-bearing bacteria.

Of course, it is undeniably true that the only sure way of killing spores is by the use of an autoclave, as Stitt points out that the spores of anthrax will resist boiling temperature for hours and Smith has shown that a temperature only possible with an autoclave is necessary to kill the spores of certain resistant strains of *Bacillus tetani.* Of the six strains of *Bacillus anthracis* used for experimental purposes in our laboratory, massive inoculations of the spores of one strain were killed by immersion in Bard-Parker solution for one and one-half hours, while equally large inoculations of another strain resisted two hours' exposure in the same solution. In the same test, a third strain was viable after thirty-six hours' immersion in 70 per cent alcohol. It is easily conceivable that especially resistant spores might withstand hours and hours of immersion in the chemical germicides.

We must admit, therefore, that theoretically every instrument should be autoclaved before being used by a dentist on a patient; although practically, if a dentist rigorously follows the procedures which will make accidental infection from non-spore-bearing pathogens impossible with particular attention to a thorough scrubbing of the instruments in running water, he will also avoid the possibility of infecting his patients with spore-bearing bacteria.

TEACHING OF STERILIZATION IN THE DENTAL SCHOOL

In 1915, in his report on *The Sterilization of Dental Instruments,* Hasseltine wrote, ''For improvement of the technique of the future dentists we should look to the dental schools. They all have courses in bacteriology which, however, in many schools are largely theoretical instead of practical. The morphology and cultural characteristics of various organisms are considered, but their resistance to disinfectants is passed over by noting what certain books say regarding this phase of the subject. Little actual laboratory work is done to show the relative value of the sterilizing agents applicable in dentistry and how their efficiency is tested. As a result the student forms the opinion that any sterilizing agent is effective, and does not learn to check his sterilization by bacteriological tests. For the coming dentists the improvement should come through the schools.''

Today, fifteen years later, the same statements and suggestions could be made. Confronted with the question, Just what method for the sterilization of your instruments will you employ when you start to practice? the men in the

graduating class of one of the well-known Eastern dental schools, men supposedly ready in a month's time to open their offices as practicing dentists, gave astonishingly vague replies. Boiling was the method of choice; some intended to use bicarbonate of soda in the water, some did not. Several spoke hopefully of owning an autoclave when they could afford it and were not sure what they would use in the meantime. Most of them planned to use alcohol as a sterilizing agent for instruments with sharp edges, but the length of time recommended for leaving the instruments in the alcohol varied from "ten to fifteen minutes" to "twenty-four hours, at least." Several of the students were going to use Bard-Parker solution or Metaphen-C, although they admitted that they did not know the efficiency of the germicides. The whole question of sterilization seemed to appeal to them as a somewhat time-worn joke. If our graduating dental students take that attitude, can we blame the dentist, trained in the old school, if he wipes his one mirror between patients, and brushes off all of his burs with the same brush, and tests the point of his anesthesia needle on his thumb, and passes on a cold this week and a streptococcus sore throat the next? The fact that dental literature has so few references to the transmission of disease through carelessness on the part of the dentist, does not mean that such occurrences are rare. It only indicates that dentists are extremely human and do not publish reports involving their shortcomings; although, in fairness, it should be admitted that infections of the type most easily transmitted through careless dental procedures are extremely difficult to trace to their source, at any time.

There is need for more practical instruction in dental schools and clinics in the methods of sterilization and in the subsequent testing of the sterilization by bacteriologic methods.

Exodontia and oral surgery are specialized branches of medicine and surgery. The dentist should study with care the skill and precision of the surgeon with regard to asepsis and should work toward this ideal.

SUMMARY

In considering recommendations for a definite routine time for sterilization of instruments by different methods, it must be remembered that autoclaving and boiling are known quantities that have survived the various tests for years. In the use of chemicals, while any short, individual study may seem to give strikingly favorable results, it must be remembered that virulent strains direct from favorable environment in clinical cases might possibly resist these chemicals, and a much wider scope of research is needed before definitely settling their status.

CONCLUSIONS

1. Autoclaving at fifteen pounds pressure for ten minutes gives 145° to 150° Fahrenheit and kills all organisms. It does not injure instruments. Sharp knives and cutting instruments may be autoclaved if protected by gauze or cotton from mechanical injury. Instruments may be sterilized in containers and carried to the operating rooms without contamination. The apparatus is fairly expensive, and a definite systematic routine is necessary, requiring time and care.

2. Boiling for ten minutes kills all organisms excepting occasional strains of spore-bearing organisms. It is the most universally used method of sterilization. It is usually necessary to use bicarbonate of soda or a substitute to prevent rusting or discoloration of instruments. For sterilization of hypodermic syringes and needles distilled water or tap water without bicarbonate is to be used. It is difficult to keep instruments in working order and free from discoloration, rust, etc. After sterilization some system must be devised, such as sterile towels or pans of chemicals, in which to carry these instruments to the operating rooms in a sterile condition. The edges of knives are injured by prolonged boiling.

3. Such chemicals as Bard-Parker solution and metaphen apparently sterilize and kill all organisms within ten minutes except certain spore-bearing organisms. The Bard-Parker, while apparently more efficient for sterilization of instruments, is more irritating to tissues. The odor is objectionable to some and any form of formaldehyde is irritating to the eyes of the operator. It evaporates rather rapidly. The metaphen solution leaves a slick, gummy surface on the instrument.

4. It is more difficult to operate with moist instruments than with dry instruments. Certain strains of organisms in a favorable environment may be very virulent and more difficult to destroy, but after culturing may be easier to destroy. There is need for still further research with these particular strains direct from clinical cases to determine the efficiency of chemicals.

RECOMMENDATIONS

1. All instruments should be properly washed and cleaned preparatory to sterilization.

2. Autoclaving is the method of choice for complete sterilization of instruments. I recommend a ten-minute period of sterilization at fifteen pounds pressure, giving a temperature of 245° to 250° Fahrenheit.

3. Boiling is the method in most general use and is satisfactory but not so efficient as autoclaving. I recommend a ten-minute period of sterilization. When a hypodermic syringe is boiled, tap water without bicarbonate should be used.

4. Chemical sterilization with Bard-Parker solution is apparently satisfactory for routine sterilization. Minimum sterilization should be ten minutes, and longer periods should be used where practicable.

5. For improvement of the technic of the future dentists we should look to the dental schools. They all have courses in bacteriology, which, however, in many schools are largely theoretical instead of practical. The morphology and cultural characteristics of various organisms are considered, but their resistance to disinfectants is passed over by noting what certain books say regarding this phase of the subject. Little actual laboratory work is done to show the relative value of the sterilizing agents applicable in dentistry and how their efficiency is tested. As a result, the student forms the opinion that any sterilizing agent is effective and does not learn to check his sterilization by bacteriologic tests. For the coming dentists the improvement should come through

the schools. For those already in practice it must come through reading and exchange of ideas among the men of the dental and medical professions.

REFERENCES

Leseurre, A.: Quelle confiance accorder á la stérilisation par l'autoclave? Bull. d. sc. pharmacol. **34**: 647, 1927.

Bruning, F.: Gegen die Verwending des Alkohols zur Desinfektion chirurgischer Instrumente, Deutsche med. Wchnschr. **52**: 1988, 1926.

Burnett, C. T.: Dry Heat Sterilization in Medical Practice, Colorado Med. **25**: 147, 1928.

Campos, E.: Sterilization of Instruments in Glycerol, Brasil-med. **1**: 291, 1925.

Devereux, E. D.: Tanner, F. W., and Wallace, G. I.: How Efficient Are Hospital Sterilizers, Mod. Hosp. **28**: 79, 1927.

Feirer, William, and Leonard, Veader: The Bactericidal Activity of Hexylresorcinol on Wound Surfaces, Surg., Gynec. & Obst. **47**: 488, October, 1928.

Finoff, W. C.: Dry Sterilization for Eye Instruments, Am. J. Ophth. **10**: 598, 1927.

Harper, John: Dressing Sterilizers With Special Reference to Temperature, Pressure, and Chamber Air Exhaustion During Process of Sterilization, U. S. Nav. Med. Bull. **25**: 62, 1927.

Hasseltine, H. E.: The Sterilization of Dental Instruments, Dental Summary **36**: 41, 1916.

Keilty, Robert A.: Specific Chemotherapeusis With Relationship to the Bacteria Involved, J. Chemotherapy **6**: 9, 1929; The Specificity of Bacteria to the Bacteriolytic Action of Chemicals With a Note on This Application to Chemotherapy, J. Lab. & Clin. Med. **14**: 539, 1929.

Kirschner, M.: Disinfection of Surgical Instruments, Deutsche med. Wchnschr. **50**: 1044, 1924.

Lahey, F. H., and Mason, R. L.: Oil Sterilization of Edged Instruments, Surg. Gynec. & Obst. **41**: 226, 1925.

Lawson, Sir Arnold: Value of Antiseptics in Modern Ophthalmic Surgery, Brit. M. J. **2**: 1128, 1927.

Lilienthal, Howard, and Zeigler, Jerome M.: A Study in the Disinfection of the Hands, Ann. Surg. **83**: 831, 1926.

Lockwood, Charles Barrett: Aseptic Surgery, London, 1909, pp. 175-201, H. Frowde.

Mead, Sterling V.: Sterilization, an Improved Technique for Operations in Oral Surgery, J. Dent. Research **9**: 6, 1929.

McGregor, A. N.: System of Surgical Nursing, Glasgow, 1905, pp. 138-142, D. Bryce & Son.

Post, M. H.: Sterilization of Sharp Instruments, Am. J. Ophth. **11**: 18, 1928.

Raiziss, G. W., and Severac, M.: New Organic Mercury Compound With Powerful Germicidal Properties, J. Lab. & Clin. Med. **9**: 71, 1923; Metaphen as a Germicide and Skin Disinfectant, J. A. M. A. **94**: 1199, 1930.

Rawdon, H. S., Epstein, Samuel: Structure of Martensitic Carbon Steels and Changes in Microstructure Which Occur Upon Tempering, Scientific Papers of Bureau of Standards, No. 452 **18**: October 9, 1922.

Reddish, C. F., and Drake, W. E.: Mercurochrome-220 Soluble and U. S. P. Tincture of Iodine, J. A. M. A. **91**: 712, 1928.

Reinmöller, M.: Instrumentenkunde, Aseptik, Antiseptik, Fortschr. d. Zahnheilk. **3**: 81, 1927.

Rideal, S. and E.: Chemical Disinfection and Sterilization, London, 1921, p. 107, E. Arnold & Co.

Rodriguez, F. E.: Mercurochrome and Iodine as Disinfectants of Mucous Membrane of Mouth, J. A. M. A. **91**: 708, 1928.

Schumburg: Die Disinfektionskraft des Alkohols, Deutsche med. Wchnschr. **52**: 2196, 1926.

Simmons, J. S.: Bactericidal Action of Mercurochrome-220 Soluble and Iodine Solutions in Skin Disinfection, J. A. M. A. **91**: 704, 1928.

Stitt, E. R.: Practical Bacteriology, Blood Work and Parasitology, Philadelphia, 1923, P. Blakiston's Son & Co.

Tinker, M. B., and Sutton, H. B.: Inefficiency of Most of the Commonly Used Skin Antiseptics, J. A. M. A. **87**: 1347, 1926.

ABSTRACT OF
CURRENT LITERATURE

NUTRITION AND PEDIATRICS

By Samuel Adams Cohen, M.D., New York City

It is the purpose of this Journal to review so far as possible the most important literature as it appears in English and foreign periodicals and to present it in abstract form. Authors are requested to send abstracts or reprints of their papers to the publishers.

A Bacteriologic and Cytologic Study of the Maxillary Antrum in Children, With a Clinical Study of 83 Cases. Byron J. Ashley and Wesley V. Frick. Ann. Otol. Rhin. & Laryng. **39**: 2, 1930.

Because of the high incidence of sinus infection among children on the Pacific Coast these investigators, reporting from the Oregon Medical School, Portland, Oregon, undertook to determine the relationship of bacteriologic to the clinical, cytologic and pathologic findings of sinus conditions in children.

They quote the work of Dean and Armstrong in 1919 who, they state, were the first definitely to establish the relationship of sinus disease in infants and children to systemic conditions. Out of 55 apparently normal cases 44 washings from the antrum were returned clear, 3 contained mucus and 8 contained pus. Sterile cultures were found in 39 cases.

After a careful study of the maxillary sinuses of 83 children from August, 1929, to April, 1930, some of the conclusions arrived at by these authors are:

1. The normal maxillary sinus does not contain bacteria.

2. The organisms commonly found in diseased antrums are the nonhemolytic staphylococci, and these are related to local processes rather than to the systemic lesion.

3. Various streptococci are associated with systemic lesions.

4. Micrococcus catarrhalis is commonly present in the maxillary sinus following acute cold.

5. Bacteria in most cases play a secondary rôle in the etiology of sinusitis.

6. A pathologic condition may be present in the antrum with only epithelial cells in the washings.

Sepsis With Leukopenia (Agranulocytosis) in children. John A. Bigler and Joseph Brennemann. Am. J. Dis. Child. **40**: 3, 1930.

The authors report ten cases of the clinical syndrome of a sepsis, severe anemia, thrombopenia and agranulocytic leucopenia in children from two to eleven years of age. No form of treatment seems to be of any help, and all the cases were fatal. Their characteristic features were septic temperature, anemia (the hemoglobin was invariably below 30 per cent, and there was al-

ways a reduction in the total red count), marked steadily increasing leucopenia (in several cases as low as 800 or 900 white cells) with a relative lymphocytosis, and always a decrease of polynuclear cells from 12 to as low as 1 or 2 per cent. The platelet counts were below normal, and there was an increase in the bleeding time, and the fact that the blood smear showed no nucleated red cells or megoblasts points to an almost complete loss of regenerative power of the blood-forming organs.

The original description of agranulocytic angina was first described in 1922 by Schultz as a condition that occurred in women, and is characterized by ulceration or sloughing areas in the mouth, fever, jaundice, rapid developing exhaustion, leucopenia, and almost complete lack of involvement of the red cells and blood platelets.

This condition has rarely been reported in children. The authors, however, state that only in one of these cases were necrotizing lesions of the mouth present. Furthermore, they state that from a study of the literature, and also from their cases, the etiology is not known, but that there are several factors which can produce this clinical and blood picture.

Acute and Chronic Otitis Media and Sinus Thrombosis. Samuel J. Kopetzky. Arch. Otolaryng. **12**: 3, 1930.

In a careful perusal of the literature for 1929 on acute and chronic otitis media and sinus thrombosis, Kopetzky, writing from the Beth Israel Hospital, New York, makes some timely comments. From the general tone of the literature on otitic infections the writer finds that there is a tendency to support the classic work of Wittmaak published in 1918, who observed that otitis media of the newborn resulted in a change of aural tissue, and this change of tissue remained. Using this observation as a background, the author notes from the current literature that various writers now believe that the local reaction of the mastoid tissue depends less upon the identity of the bacterial invader and more upon its structural constitution. For this reason, this expert does not agree with the opinion of Hoffman of Vienna, that bacteria play the major rôle in the protraction of an acute otitis media to a chronic one. In another article Hoffman noted that after the fourth year of life the frequency of otitis as a complication of pneumonia became less and less, and also that otitis occurred less frequently and was less virulent with lobar pneumonia than with bronchopneumonia.

The author concurs in the opinion expressed by Hayman that bacteria can penetrate the sinus wall and lead to sepsis without producing a thrombosis in the sinus itself. Animal experiments of Coldera and Fienzi, in addition to the clinical and experimental work on dogs and monkeys by Hayman, have substantiated the observations of Romer, Beck and Kopetzky on acute hemorrhagic mastoiditis. These authorities noted that acute hemorrhagic mastoiditis produces sepsis from the outset of the disease, and, perhaps, what is most important from the point of view of therapeusis, is that the septic focus in such cases is within the middle ear and mastoid process and not in the sinus.

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EDITORIALS

The Cost of Dental Care as Influenced by the Cost of Dental Education

A GREAT many articles have appeared in the newspapers, magazines, and dental journals regarding the cost of dental care. The expense of professional services has received considerable discussion from various sources during the last few years. Many factors enter into this question, but one factor which seems to be almost entirely overlooked is the influence of the cost of education on the cost of service. The public and the profession have paid very little attention to dental education in years past. The present program of dental and medical education has been brought about by the action of a few educators, who have given no consideration to the cost of professional service rendered the public, or to the influence of the plan of education upon the cost of the service.

Educators have been working toward a plan conceived purely from the standpoint of education. It has for its object the keeping of the student in school as long as possible without any consideration being given the effect such

a plan has upon economic conditions. This is true not only of professional education but also of elementary education in the high schools and grade schools. If the educational system of the United States were examined from a practical standpoint and were forced to compete with economic conditions the same as business concerns are forced to do, the plan from the primary schools to the universities would have to undergo radical changes. We know of no business which spends money so recklessly or has so little regard for money and time as American educational institutions under the present plan.

The climax is seen in the medical and dental schools of today. The student is forced to study a great many subjects and to spend a great amount of time on so-called premedical and predental education; this simply adds to the cost of education and therefore to the cost of medical and dental service, without any evidence of its improving the service. We believe that through reorganization, placing the system of education on a practical basis, four years could be saved the student in obtaining his professional education. This would be a great saving not only to the student, but to the community and the public as well. The saving of these four years would reduce the cost of dental education as well as the student's investment in money and time, and these factors necessarily must be considered in the cost of service to the public.

The statement has often been made that dental students do not receive the proper instruction on dental economics in dental schools. This is not surprising when we consider that the present plan of education is such as to make proper instruction in dental economics impossible. A great many educators insist that instructors in dental schools be full-time men. Very often these full-time professors attempt to give instruction in dental economics and the cost of dental service. They themselves have been professional failures, or they would not be occupying full-time positions, and they never come in contact with the problems which the students are compelled to face when they begin to practice. A professor who devotes all of his time to teaching and receives a salary that is paid to a professor today is either a man who could not make a living engaged in private practice or one who is so engrossed in scientific research as to be entirely out of touch with the problems of professional life. Neither type of man is suited to give proper instruction to students on dental economics.

Among the first things to be considered in relation to the cost of professional service are a careful study of the cost of dental education and a revision of the entire curriculum in such a way that the student can be saved a considerable amount of time and money on his education.

The next consideration is a reformation of the present obsolete plan of education and a reversion to the more practical plan in which the instructors in medical and dental schools were men engaged in private practice and therefore were both professional and economic successes. It would be much more satisfactory from a standpoint of education and dental economics if a revision of the system of dental education were made, if a large number of these full-time professors were placed on pensions, and if men were engaged who know something of the problems with which the students will be confronted.

It is our opinion that very little will be accomplished in solving the problem of the cost of dental care until dental education has been "revamped."

NEWS AND NOTES

Great Lakes Association of Orthodontists

The Great Lakes Association of Orthodontists will hold its next regular meeting in Toledo, Ohio, February 16 and 17 at the Commodore Perry Hotel.

Among the essayists are: Drs. V. E. Barnes, B. Holly Broadbent, A. F. Jackson, Howard Jackson, H. A. Pullen, and others. A large number of clinics have already been received.

A cordial invitation is extended to the dental profession.

E. N. BACH, President,
1307 Second National Bank Bldg.,
Toledo, Ohio.

S. A. MACKENZIE, Secy.-Treas.,
1011 Stroh Bldg.,
Detroit, Mich.

The American Board of Orthodontia

Certificates of the American Board of Orthodontia have been issued to the following men who have completed the Board requirements: Ernest N. Bach, Toledo, Ohio; Charles R. Baker, Evanston, Ill.; Oscar Carrabine, New York City; Frank M. Casto, Cleveland, Ohio; Albert W. Crosby, New Haven, Conn.; Frank A. Delabarre, Boston, Mass.; William E. Flesher, Oklahoma City, Okla.; J. A. Gorman, New Orleans, La.; Henry F. Hoffman, Denver, Colo.; Harry L. Hosmer, Detroit, Mich.; Clinton C. Howard, Atlanta, Ga.; William R. Humphrey, Denver, Colo.; Bernard L. Hyams, Montreal, Canada; Harry E. Kelsey, Baltimore, Md.; B. E. Lischer, San Francisco, Calif.; John V. Mershon, Philadelphia, Pa.; Harry L. Morehouse, Spokane, Wash.; Frederic T. Murlless, Jr., Hartford, Conn.; James D. McCoy, Los Angeles, Calif.; Herbert A. Pullen, Buffalo, N. Y.; Alfred P. Rogers, Boston, Mass.; Harvey A. Stryker, Santa Ana, Calif.; Allen H. Suggett, San Francisco, Calif.; Leuman M. Waugh, New York City; B. W. Weinberger, New York City; Oliver W. White, Detroit, Mich.; Raymond C. Willett, Peoria, Ill.; J. Lowe Young, New York City.

December Meeting of the Society for the Advancement of General Anesthesia in Dentistry

The next meeting of the Society for the Advancement of General Anesthesia in Dentistry will be held on Monday evening, December 15, at the Barbizon-Plaza Hotel, northwest corner of Fifty-Eighth Street and Sixth Avenue, New York City at 7 P.M. The meeting will open with a dinner at 7 o'clock, and the scientific session is scheduled to start at 8 o'clock promptly.

Dr. Wm. J. McLaughlin, chief of the dental staff of St. Vincent's Hospital in Bridgeport, Conn., will read a paper entitled, "Considerations of Technic Concerned in the Induction and Maintenance of a Short and a Prolonged General Anesthesia for Dental Surgery." The discussion will be opened by Dr. Walter F. Barry of Newark, N. J.

Following Dr. McLaughlin's paper, Dr. Paul M. Wood of New York City, director of anesthesia at Lincoln Hospital and assistant attending anesthetist at Roosevelt and Fifth Avenue Hospitals, New York City, will speak on "A Comparison of the Phenomena of Normal Physiologic Respiration and Anesthetic Respiration."

Membership in this society is open to all ethical practitioners, and correspondence is invited. Meetings are held four times a year on the third Monday of October, December, February and April, in New York City.

M. Hillel Feldman, D.D.S., President,
730 Fifth Avenue,
New York City.

Leonard Morvay, D.D.S., Secretary,
76 Clinton Avenue,
Newark, N. J.

James T. Gwathemey, M.D., Honorary President,
30 W. Fifty-Ninth Street,
New York City.

Orthodontia Department of Washington University School of Dentistry

The dental department of the Washington University, St. Louis, Mo., has established a full-time interneship of one year in orthodontia.

The department is in the charge of Dr. H. C. Pollock; and one year's interneship, which is in the nature of a full year's postgraduate course, has been assigned to Dr. E. V. Holestine, Ava, Mo.

Future applicants who care to take advantage of this course should address all communications to Dr. R. E. Fobes, Registrar, Washington University School of Dentistry, 4559 Scott Avenue, St. Louis, Mo.

The Southwestern Society of Orthodontists

The Southwestern Society of Orthodontists will meet in San Antonio, Texas, January 7, 8, 9, 10, 1931. January 7 will be devoted to golf, and some of the members will be in San Antonio in advance of that time, perhaps on January 4, 5, and 6, in order to have a hunting and fishing trip on the Gulf before the meeting starts.

Dr. Curtis Williams, Secretary,
716 Medical Arts Bldg.,
Shreveport, La.

Chicago Dental Society Midwinter Meeting

The sixty-seventh annual meeting of the Chicago Dental Society will be held at the Stevens Hotel, Chicago, February 2, 3, 4 and 5, 1931.

Because of the great demand last year, the transactions of this meeting will be bound and made available at cost to those who wish them.

The program committee, Dr. Stanley D. Tylman, chairman, has practically finished its work and will present, for the approval of the profession, one of the best programs in the history of the Society.

The exhibition hall of the Stevens Hotel has again been reserved by the Exhibit Committee, of which Dr. C. Davidson is chairman, for manufacturers' and dealers' exhibits and will as always be a center of attraction.

The Society extends a cordial invitation to attend to all members of the American Dental Association.

Harris W. McClain, President,
55 E. Washington St.,
Chicago, Ill.

Howard C. Miller, Secretary,
55 E. Washington St.,
Chicago, Ill.

American Society of Orthodontists

The Thirtieth Annual Meeting of the American Society of Orthodontists will be held on April 21, 22, 23, and 24, 1931, at the Jefferson Hotel, St. Louis, Missouri.

DR. HARRY E. KELSEY, President,
833 Park Avenue,
Baltimore, Md.
DR. CLAUDE R. WOOD, Secretary,
Medical Arts Building,
Knoxville, Tenn.

Southern Society of Orthodontists to Meet in January

The eleventh annual meeting of the Southern Society of Orthodontists will be held at the New Fleetwood Hotel, Miami Beach, Florida, January 13, 14, 15, 1931.

The Board of Censors is preparing a program that will be both interesting and of high scientific value.

Among the essayists will be Dr. Alfred P. Rogers of Boston, Dr. A. LeRoy Johnson of New York City, Dr. Herbert A. Pullen of Buffalo, Dr. Frank M. Casto of Cleveland, and Dr. W. W. McKibben of Miami.

An invitation is extended to all members of the dental and medical professions to attend this meeting.

CARLTON B. MOTT, President,
Flatiron Building,
Asheville, N. C.
OREN A. OLIVER, Secretary-Treasurer,
Medical Arts Building,
Nashville, Tenn.

A Call to Graduates of the Angle School of Orthodontia

A suggestion has been made by a number of graduates of the Angle School of Orthodontia that we hold a gathering of a social nature at a dinner to be given just preceding the meeting of the American Society of Orthodontists to be held at St. Louis, Mo., in 1931.

The American Society of Orthodontists was organized in St. Louis on June 1, 1900. This is a cogent reason, but only one of the reasons, why we should get together at this time and place. All who favor this idea will kindly and promptly communicate with

RICHARD SUMMA,
5552 Etzel Avenue,
St. Louis, Mo.

Second International Orthodontic Congress

The Second International Orthodontic Congress will be held in London in 1931 at the Hotel Great Central from July 20 to 24 inclusive.

The officers of the Congress will be as follows:

President-General	J. H. Badcock
Vice-President-General	G. Northcroft
Treasurer-General	E. D. Barrows
Secretaries-General	A. C. Lockett
	B. M. Stephens

A list of honorary presidents and vice-presidents will be communicated later.

A full and interesting program of papers and demonstrations is anticipated, and a museum is being organized. Suitable entertainment for ladies accompanying members will be arranged. Intending contributors to the activities of the Congress can obtain from the Secretaries of their respective orthodontic (or dental) societies the conditions under which contributions are invited. The Secretary-General (Mr. A. C. Lockett, 75 Grosvenor Street, London, W. 1) will also be glad to give any further information on request.

Information regarding travelling facilities and hotel accommodation may be obtained from the official agents to the Congress, Messrs. Morgan Pope & Co., of 7 St. James's Street, London, S. W. 1; 6 Rue Caumartin, Paris; 71 Vanderbilt Avenue, New York; Messrs. Noel Vester & Co. (agents), 44 Unter den Linden, Berlin.

The Eastern Association of Graduates of the Angle School of Orthodontia

A regular meeting will be held at the Vanderbilt Hotel, New York City, on Monday and Tuesday, January 26 and 27, 1931. This meeting will be a memorial to the late Edward H. Angle.

E. SANTLEY BUTLER, Secretary,
576 Fifth Avenue,
New York, N. Y.

The Dental Society of the State of New York

The sixty-third annual meeting of the Society will be held May 12, 13, 14, and 15, 1931, at Hotel Pennsylvania, New York City.

A cordial invitation is extended to all dentists, members of the American Dental Association, and to all ethical Canadian dentists.

Dr. John T. Hanks, 17 Park Ave., New York City, is Chairman of the Exhibits Committee. Address Dr. Hanks for information relative to space and terms.

Dr. Fred R. Adams, 7 W. Fortieth St., New York City, is Chairman of the Clinic Committee. Under his direction a new plan will be presented in the presentation of the Educational Clinics. Dr. Adams will be pleased to hear from ethical dentists willing to present clinics of merit.

For general information address the Secretary, Dr. A. P. Burkhart.

DR. ALFRED WALKER, President,
100 W. 59th St., New York City.
DR. A. P. BURKHART, Secretary,
57 E. Genesee St., Auburn, N. Y.

Dallas Mid-Winter Dental Clinic

The Dallas Mid-Winter Dental Clinic will be held February 16, 17, 18, 1931. The following clinics will be presented: Crown and Bridge by Dr. H. G. Morton of Milwaukee; Surgery by Dr. Arthur C. Engle of St. Louis; Prosthetics, the clinician has not yet been selected. There will be exhibits by national manufacturers.

DR. ROLAND LYNN,
1807 Medical Arts Building,
Dallas, Texas.

Notes of Interest

Dr. Clifford J. Waas announces that he has opened an office in the Medical Tower, 31 Lincoln Park, Newark, N. J. Practice limited to children.

Dr. Stephen J. Lesco announces the opening of offices at 322 Medical Arts Building, Toronto, Canada. Practice limited to orthodontia.

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EDITORIALS

VALUABLE SUGGESTIONS FOR CONTRIBUTORS TO THE INTERNATIONAL JOURNAL OF ORTHODONTIA, ORAL SURGERY AND RADIOGRAPHY

"The four rules for the preparation of an article will then be: (1) Have something to say; (2) Say it; (3) Stop as soon as you have said it; (4) Give the paper a proper title."[1]

Let your phraseology express one meaning and one only. Be clear.[2]

Manuscript.—Manuscripts should be typewritten, with wide margins, and double spaced, on one side of paper 8½ by 11 inches in size. The original copy should be sent to the editor of the journal and the carbon copy retained by the author. Number the sheets consecutively, beginning with the title page. Put your name and address on the manuscript.

Illustrations.—Illustrations should be clear, preferably pen-and-ink drawings. Of photographs send a good print rather than a negative. Have lettering parallel to the bottom and top margins, and of sufficient size to be clear if cut is to be reduced. Tracings should be in black-and-white; avoid colors. Write your name on back of each picture; number them in one series (Fig. 1, etc.) to the end, and indicate in margin of the manuscript about where each is to be printed. See that text references and "figures" correspond. Legends for illustrations should be written on a separate sheet.[3]

Bibliographic References.—Give only references actually consulted. If an article is known only through an abstract give reference to the abstract in addition to that of the source. References are printed to be of help in further reading; therefore they must be complete, concise, and correct. Follow the style of the "Quarterly Cumulative Index." Be conservative in the use of abbreviations.

Arrangement.—As authors are quoted in the text give each a number in the order of citation, and number the bibliographic reference with the same number. Arrange the references in a list at the end of the article in the order of the numbers (see below), or arrange items in alphabetical order according to last names of authors, and distinguish between articles by the same author by the use of the date after his name in the text.

Footnotes.—Footnotes should be placed at bottom of each page. Indicate footnotes by an asterisk (*).

Final Reading.—Let some one other than the author read the manuscript with these directions in mind.

Shipment.—Send manuscript flat, postage paid, to the editor, Dr. Martin Dewey, 17 Park Avenue, New York, N. Y.

Proof Reading.—Read carefully, with special attention to spelling of names and bibliographic data. Make corrections *in the margin* only with lines drawn from the revision to the point of change in the text. Answer queries in the proof by making correction or crossing out the query. Verify your references from the sources, not from your carbon copy.

References. (Read these.)

[1]Billings, J. S.: Our Medical Literature, Trans. VII Intern. Med. Congress, Lond., 1: 54-70, 1881.

[2]Mayer, Emil: Medical Literature and its Preparation, Med. Record, N. Y. 87: 1019-1021, 1915.

Allbutt, T. C.: Notes on the Composition of Scientific Papers. London, Macmillan, 1904.

McCrae, Thomas: The Use of Words, Jour. A. M. A., Chic., 65: 135-139, 1915.

[3]Suggestions to Medical Authors, issued by the A. M. A. Press, Chic., A. M. A.

(See page 1329 for further information.)

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This book service department has become very popular with our subscribers. The list is revised monthly and new books added as brought to our notice. See following pages for other books and order form.

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